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Department of Agriculture and Commerce,
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# PAPERS

RELATING TO THE

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# CONSTRUCTION OF WELLS

# FOR IRRIGATION

IN THE

# NORTH-WEST PROVINCES.

00108322

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1883.

THOS. D. BONA, SUPERINTENDENT.

# CONTENTS.

1. Report on Well Irrigation in the North-Western Provinces and Oudh, by Captain Clibborn, B. S. C, Executive Engineer, on Special Duty with the Department of Agriculture and Commerce.

2. Note on the Construction of Wells on the Awa Estate, by W. J. Wilson, Esq., Executive Engineer, Department of Agriculture and Commerce.

3. Note on the Moradabad Wells.

4. Tables and Appendices to Captain Clibborn's Report.

B. 76

No. of 1883.

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From

The DIRECTOR, DEPT. AGRI. and COMMERCE,
North-Western Provinces and Oudh.

To

The SECRETARY, BOARD of REVENUE,
North-Western Provinces.

*Dated Cawnpore, the 27th May*, 1883.

Sir,

I have the honor to submit—

(1). A Note by Captain Clibborn, Executive Engineer, on the results of the enquiry into the general subject of the Construction of Wells, for which he was specially deputed last year.

(2). A Note by Mr. W. J. Wilson, Assistant Engineer, on deputation with this Department, on the Construction of Wells on the Awa Estate.

2. As this appears to be a convenient occasion to review the origin and results of the action taken by Government in the matter of well building, I have had bound up with the above Reports a Note on the Experimental Wells in Moradabad, giving their history to the end of July 1882, when the officer in special charge of them was removed. It has not been thought necessary to give any account of the Cawnpore wells, as that experiment was closed and reported on more than two years ago. Since the date of the papers now submitted further action has been taken. Captain Clibborn was deputed early in the cold weather to make special report on the condition of well construction on Raja Shambhu Narain Singh's estate in Ghazipore, and Mr. Wilson has not only made further progress with the Awa wells, but has visited several districts to advise with Collectors on irrigation projects, and is now commencing a new experiment at Khairagarh in the Agra District.

3. The subject was forced on the attention of Government by the famine of 1877-78. The experience of several years had shown that the protection of any considerable areas by well irrigation could not be looked for as the result of advances under the existing Takkavi Act, and it became necessary to decide how the action of Government could be made more direct, and more effective. After an extended enquiry the Board of Revenue drafted a Bill, the main object of which was contained in its third section, which provided that whenever it might be proved to the satisfaction of the Local Government that in any tract of country or in any mahal the construction of wells for irrigation was required to protect the area from famine or the effects of drought, and that such wells

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would not otherwise be constructed, the Local Government might order the construction of wells in such number and of such description as might be deemed necessary.

4. In a Note on the proposed scheme by Mr. Buck, who was then Director of Agriculture and Commerce, it was pointed out that it was first necessary to ascertain whether the construction of wells in any tract was 1, feasible; 2, remunerative; and it was suggested that certain figures which he had brought forward should be tested by experiments, the trial of which should be made by the Agricultural Department, one of whose main duties was the study both of well construction and of water lifts. It was further urged that the special difficulties of the undertaking could not be met without a combination of revenue knowledge with engineering skill, and that success could not be expected from the unassisted agency of the ordinary District staff.

5. In its order reviewing the voluminous notes and suggestions which had been put before it, Government remarked on the insufficiency of the data, and the uncertainty with which the whole subject was involved, and expressed a fear that hasty action for the general construction of wells would lead to nothing but disappointment and disaster. It was thought that there was no section of agricultural operations which depended upon more numerous or more intricate conditions, both above the ground and under the ground, than well irrigation, and that before any compulsory measures for the construction of wells by the State could be adopted, it would be necessary to make detailed enquiries in every tract to which operations were to be extended. As a preliminary measure two tracts were to be chosen in different parts of the Province in which there were *primâ facie* reasons for believing that wells could be constructed at a reasonable cost with advantage to the agricultural community, and a special officer was to be deputed to each to find out in each village whether or no wells could be made. If it was found that they could, he was to receive special engineering assistance, and the whole work was to be under the general superintendence of the Provincial Department of Agriculture, which was to assist with its advice the officers engaged, and review the progress of their work for the information of Government.

6. These views were put into effect by the institution of experiments under Mr. Wright at Cawnpore and Mr. Smeaton at Moradabad. In the autumn of 1881 it was thought possible that sufficient experience had been gained to warrant the expenditure of a large sum of public money, and Captain Clibborn was deputed to make a tour of the Provinces, and report the localities in which wells could be most profitably constructed by the State, and the conditions of their construction. Some years ago the Board of Revenue authorized Mr. Crooke, the Manager of the large Court of Wards Estate of Awa, to invest three lakhs of its savings on wells; the work was entrusted to Mr. Wilson, and has since been conducted under his supervision. It remains to be seen what lessons have been taught by the experience of the last four years on the general question of well building, and what further action Government can take in the matter.

7. The first result of these enquiries is to discredit the distinction which used to be drawn between spring and percolation water. The President of the Famine Commission says that "the putting down of a borer and coming on water proves nothing. It may be a spring or a trickle from percolation." But it now appears to be certain that there is nothing resembling an artesian basin in these Provinces, at any rate at a depth which it is possible to sink a cylinder well.* There is no continuous impervious stratum separating the water which comes in from the bottom from what would percolate through the sides of a well; and therefore no true spring. The water at every depth of a water-bearing stratum is connected, and the same in origin. If it were otherwise, and the water were drawn from different sources, there would be no connexion of cause and effect between the water outside and the water inside of the cylinder of a so called spring well. But it is a known fact that the discharge into a well is regulated by the height of water outside it, and that the level of the former is determined by its tendency to reach the level of the latter. The only true spring is not a natural, but an artificial one, and is first formed when the cylinder of the well interposes an impervious barrier to the water outside it.

8. The main difficulty then in well construction is not the discovery of water. The water level is known locally all over the Provinces, and the information is being collected on a map, which it is hoped may shortly be published by the Department. The subsoil water supply in the greater part of the Provinces is practically inexhaustible, and in ninety-nine cases out of a hundred, if a well fails, it is because the locality selected will not support the weight of the cylinder. The conditions under which a well is stable are well described in Captain Clibborn's Note. The resistance of sand to the passage of water will cause a hollow to be formed under every well, and the contents of this hollow will be carried in with the water, till the discharge within the hollow has been distributed over a surface which is sufficiently large to reduce the velocity at any given point to such a degree as will enable the sand to deliver the water without being disturbed. This point was illustrated by some experiments made by Captain Clibborn with a half well sunk in a box full of sand and fitted with a glass face. As long as there was only little water in the box, and a very slow discharge into the bottom of the well, the water came up quite clear, and without disturbing the sand. But directly the velocity of the water was increased by adding to the head in the box, it brought up large volumes of sand with it into the well. What the area of this hollow should be depend on the amount of water drawn within a given time from the well, and on the size of the particles of which the sand is composed, as fine sand offers more resistance to water than coarse. But in the case of wells to be used for irrigation purposes, from which a large and constant supply is expected, its diameter will always be much greater than the diameter of the curb of

* There may be local exceptions, as at Benares, where phenomena resembling an artesian discharge have been noticed, but none have been proved, and if they exist they are too rare to affect the general problem of well sinking.

the well. The consequence is that in a very short time the cylinder, unless it has some other support than the sand underneath it, slips into the hollow which has been formed by the water drawn into the well. This necessary support is given by the clay stratum, known as the mota, which must interpose between the cylinder and the hollow formed by the water discharge, in order that a well may be stable.

9. All that is known about this clay stratum is that it is not continuous, and that its occurrence in one place is no indication that it will occur in another, perhaps only a field off. The extreme capriciousness and uncertainty of its distribution is illustrated in every locality where trial borings or experimental wells have been made, and may be seen on a small scale in the extraordinary diversities of the subsoil strata within the space of a few hundred square yards which were mapped by Mr. Wilson, and published with last year's Administration Report.

10. The first problem in well construction is to discover this indispensible stratum to rest the well on, and whether it is thick enough to bear the weight which will be put upon it. How fully alive to this fact the natives of these Provinces are, may be gathered from the care with which they treasure up and hand down the tradition of every spot where at any distant period clay has been found within a serviceable distance. It is the want of this knowledge which causes the innumerable failures they meet with in their attempts to sink wells, and forms the principal source of discouragement to the further extension of this form of irrigation. If wells are ever to be built by the State, it is absolutely necessary that some cheap means should be devised for ascertaining what the subsoil strata are, before any well is commenced, and there is no way in which professional aid could more profitably be given to native efforts. An instance of what is of constant occurrence all over the Province was furnished by Raja Shambhu Narain Singh, who was encouraged by the success of some neighbouring villagers to attempt the construction of wells on his own estate. They probably had the advantage of some old tradition, and hit the clay, but he failed to do so, and his money was thrown away, with the effect of making him give up the project of investing a very large sum in this form of improvement. There is little reason to doubt that if he had known how to take preliminary borings he would have found mota for as many wells as he could wish or afford to construct.

11. Another case in which this knowledge is very frequently wanted is when a thin mota has given way in consequence of the enlargement of the hollow beneath by an unusual demand on the water supply. In a very large number of instances a second mota can be found within a short distance of the first, and the continuation of the cylinder will restore the well to its original usefulness. But in the absence of the necessary knowledge the well is given up, and all the money and labor which has been spent on it is wasted.

12. Though the importance of finding a mota was not known, it appears to have been very much undervalued before the commencement of the present experiments, and its exact meaning was perhaps not quite clearly understood. The common impression appears to have been that

it was wanted because it covered a spring which would not otherwise be found, but this, as has been stated, is a mistake. If its real use had been known, we should not have had the numerous wells resting in pure sand at Moradabad, or the wells which Captain Clibborn saw on the Ghazipore farm, all of which rest on sand, and are therefore next to useless, though there is plenty of mota in the immediate neighbourhood. It is safe to say that if Government had then undertaken a large scheme of compulsory well construction, a very considerable proportion of the wells made would have been failures for the want of clear ideas on this point.

13. When the subject was first taken up by Government, the implement used for taking borings was an auger, which was both expensive in use and liable to get out of order. In sand it was nearly useless. Mr. Wilson has introduced, and is continually modifying and bringing to greater perfection a sand pump, which it is believed was first introduced into this country for the attempted artesian well at Umballa. With this he is already able to make trial borings to as great a depth as is likely to be required, at a total cost of Rs. 5 for each boring.

14. There are many cases in which it appears possible that wells may be constructed under conditions which native well sinkers would think hopeless. The first of these is where there is so great a distance between the water level and the clay mota, that the continuation of the brick cylinder to the latter would be unremunerative. The only use of the cylinder is as a reservoir to hold water, and if its contents are sufficient, that is to say if it is prolonged far enough below the external water level to allow for loss of head by work, and the play of the buckets, there is no use in continuing it any further, and the additional masonry used to bring it on to the clay is, except to make it stable, so much money thrown away. It has now been found that the same stability can be secured by making an impervious cylinder of the size only that is required for a water cistern, and continuing it down and through the clay by an iron tube, which will cost only a small fraction of the expense of a masonry cylinder to the same depth, and answer quite as well. The diameter, material and construction of tube to be used have been the subject of numerous experiments by Mr. Wilson, and some of his conclusions are given in the accompanying Note. How great a saving might be effected by this plan of sinking may be gathered from a comparison of the table of estimated cost given by Captain Clibborn on page 14 of his report with that given by Mr. Wilson in section 47 of his. Captain Clibborn estimates that an $8\frac{1}{2}$ feet diameter well sunk 60 feet to the water surface, and therefore with a total length of cylinder of about 90 feet, would cost Rs. 1,634. A tube well sunk 130 feet below the water surface, and with a total depth from the ground of 142 feet, or half as much again as that of the cylinder well, is estimated by Mr. Wilson to cost between Rs. 828 and Rs. 888, or little more than half the price of the shorter well.

15. Even more important are the experiments to ascertain whether it may not be possible by the introduction of a filter bed of coarse gravel, or other permeable but not easily disturbed substance either at

the sides of percolation, or the bottom of spring wells, to increase the area of discharge in a sandy stratum without endangering the safety of the well. If this problem is solved, with a due regard to expense, and there appears to be no reason to consider it insoluble, there is hardly a place in the Provinces, except where the water level is unusually low, where wells could not be sunk, and it is not too much to estimate that the area that might be protected by them would be doubled.

16. An instance where the deficient knowledge of natives in well sinking has received a valuable addition may be found in Mr. Bull's patent dredger, which greatly reduces the cost and difficulty of sinking wells through a sandy. stratum.

17. It would clearly be inequitable to embark on a scheme of compulsory well construction on the understanding that the cost of the wells was to be realized from the men on whose land they are constructed, unless there were definite proof that a sufficient return would be realized from the money invested. The first question to be decided was what would be cost of well at different depths and of different sizes. An estimate was given in the Note submitted by Mr. Buck in 1877, another is given by Captain Clibborn in his Report now under submission, while Mr. Wilson gives an account of the cost of the wells he is building on the Awa Estate. The fact appears to be that no general answer is possible, not only are the circumference and depth to water surface insufficient data for a judgment as to what a well will cost, but whether or no a well will be remunerative depends to a very great extent on its being adapted to a number of conditions which may vary with every locality.

18. Before any steps can be taken it must be decided whether any form of masonry well will cost less in the interest to be charged on capital outlay, plus an allowance for repairs and the extinction of the capital cost, than kacha wells to irrigate the same area. This too is a question to which no general answer can be given. The decision must depend on the peculiar conditions of the locality, and any new tract in which operations are contemplated may present conditions not hitherto considered. As a rule there can be little doubt that even where kacha wells can be made, masonry wells are in the long run the more valuable. Where water is met at a reasonable distance, and there are no unusual engineering difficulties, Captain Clibborn considers that a return of Rs. 2 per acre will be sufficient to pay for the cost of a packa well even on the expensive scale of construction which he contemplates, and there are not many places where an acre can be watered from a kacha well for the same expense. There are besides several advantages in a well which has not to be renewed every or every other year. In the first place it is ready for use directly after the conclusion of the ordinary period of the rainy season, at a time when kacha wells will not have been made, and its water is available for the sowing of the spring crops. The frequency of the failure of the later rains makes this a point of very great importance. In the second place, even if water is not wanted for the cold weather sowings, the construction of kacha wells takes up labor at a time when it is most urgently wanted in the fields. In the third place the

kharif crops can be saved, if irrigation is wanted, from a masonry well, and finally, there is this very great advantage that a kacha well is nearly always useless in a season of drought at the very time when water is most needed.

19. There are, however, cases where masonry wells are only preferable to kacha wells in times of drought, and others where they have no decided superiority even then. An instance of the first class of conditions may be found in the sandy plateau on which the majority of the Moradabad wells have been made. Kacha wells can be built there at a very trifling cost, and are only used to irrigate expensive crops, such as sugar, which are not sown on the same field in two consecutive years. Besides their cheapness, they have the further advantage that they can be moved every year to the place they are required to irrigate. On the other hand, owing to the looseness of the soil, they could not be dug if a drought caused a considerable fall in the water level, and masonry wells, though they could hardly be expected to pay in ordinary years, would be invaluable as a protection against famine. Moreover, it is worth considering whether wells, like canals, by raising the standard of cultivation, may not eventually create the conditions of their own remunerativeness.

20. If I correctly understand the conditions of well irrigation in the neighbourhood of Farukhabad, they present a case where under no circumstances would a masonry well have the advantage. The water surface, which is at a depth of about 35 feet, and would therefore make a deep and expensive cylinder necessary, is reached through a continuous stratum of such a firmness that it will stand without support for a long series of years. I am told by Captain Clibborn that he observed similar conditions in the neighbourhood of the State wells at Cawnpore. They are certainly not common, but in places which are fortunate in having a firm subsoil to a sufficient depth below the water surface, the wells can be easily dug out a few feet deeper to meet any abnormal sinking in the water, and the expense of building masonry wells would be as much thrown away for times of drought, as for ordinary seasons.

21. A point much discussed when this subject was taken up in 1877 was whether big wells or small paid best. It was then generally thought obvious that as the cost of a well did not increase in the same ratio with the number of buckets it could accommodate, the bigger a well was the better it would pay. But it is now seen that this is only one of a good many factors in the problem. As was pointed out by Mr. Buck, the loss of water by evaporation and absorption along a long watercourse might more than extinguish the advantage of the greater cheapness per bucket in the construction of the well. Captain Clibborn has made careful enquiries on this point, and finds that this loss on ordinary soils amounts to two cubic feet per foot run of watercourse in the day, and is so great that it would pay to add Rs. 300 to the cost of a four lift well in order to save the water. Mr. Bull, the Proprietor of the Patent Dredger, who has had very great experience, is of the opinion that the smaller the wells are the better they pay, and would reduce the diameter of all to 3 feet or even less if it were found possible to build them smaller. Neighbouring

districts will be found where it is the practice to build large wells in one, and small in another, and it is probable that the choice in each case has been decided by the wants of the locality. Even for the same number of buckets very different sized diameters may be required, as the size of the buckets varies from $1\frac{1}{2}$ to more than $7\frac{1}{2}$ cubic feet, being generally determined by the quality of cattle in general use, and the style of irrigation.

22. Not only the diameter, but the depth of the cistern that will be required, the thickness of the steining, whether the well should be made impervious and fed from beneath, or composed of dry laid bricks and supplied by percolation through the sides, are all questions in which the answer depends on a number of conditions which vary everywhere, and the selection of the kind of well that will prove remunerative requires an amount of special knowledge which cannot be expected except in a man who has devoted some time to the study.

23. The want of men who have the requisite qualifications is not the only difficulty which would meet Government if it attempted a large scheme of compulsory well making. The cost and difficulty of supervision form an obstacle which it is almost more difficult to overcome. The experience of works undertaken by Government agency as quoted by Captain Clibborn, shows that 27 per cent. on the cost of the work should be allowed for establishment. Wells would be scattered over a large area of country, and would require constant inspection to provide against the fraud of the contractors which must be employed. It is probable that the cost of supervision would bear a higher proportion to the cost of work in the case of wells than where the expense is concentrated on a smaller area. Then there would be the contractors' profits, a not inconsiderable item, to be allowed for, and finally there would be the loss not only of the supervision which a private man could give without cost, and with the best chance of its being efficient, but of the wood and private labor which he can contribute much more cheaply than it could be obtained by Government, as in many cases it would be the mere utilization of resources which would otherwise have laid idle. It is perhaps not too much to say that a well constructed by the State compulsorily, and without the hearty co-operation of the villagers, would cost twice as much as a well equally good but made by a private person. The conclusions arrived at in the enclosed reports would seem to show that only under favorable circumstances can wells constructed at the rates there specified prove remunerative. But there is a constant sliding ratio between cost and profit. As the water surface becomes deeper the area that can be irrigated by the same labor becomes smaller, and there is a constantly diminishing return to a constantly increasing expense. By leaving the construction of wells to private individuals, not only is the remuneration under favorable circumstances increased, but the area over which it will prove remunerative at all is largely extended.

24. When all these considerations are borne in mind, less surprise will be felt at the unwillingness of the zemindars both at Moradabad and at Cawnpore to render themselves responsible for the cost of the

wells before any had been constructed. They knew the difficulties which were to be encountered, of which only a dim presentiment, if any, existed in the minds of the Government officers employed; and it is not too much to say that even now, when it is far better informed than it was then, if Government were to take any large scheme of compulsory well construction it would almost certainly be doomed to failure.

25. The advantages of well irrigation are too well recognized to require being described at length. The wells already in existence provide for 57·8 per cent. of the whole irrigated area, whereas canals only water 24 per cent., and tanks, ponds, rivers and all other sources 24·2 per cent. In ordinary years it doubles the produce, and in times of drought it is usually sufficient to carry the people through one season of failure of the rains. The distance to which the water level falls after one such failure is a subject on which the information is defective, but such enquiries as have been made would seem to show that it was usually not more than 5 or 6 feet, and this is what Mr. Wilson allows for in building the cylinders for the wells in his charge. Rae Bareli is one of the districts in which well protection is most general. After the almost total failure of the rains in the northern tahsil in 1877, the wells still contained a sufficient supply to save a good spring harvest. Hardly any cultivators came to the relief works, and no relief would have been wanted throughout the cold season if rain in January had not thrown the agricultural laborers out of work. A second and almost as complete a failure of the rains occurred in 1880, and in that year, when the necessity for labor at the wells continued all through the cold weather, an excellent spring harvest was saved, entirely sown and supported on well water, and no class in the community felt the want of Government relief. The failure of the late rains which serve for the rabi sowings is far more frequent than a complete drought, and in those cases wells enable a spring crop to be sown, which may be kept alive either by further irrigation or by the following winter showers. Without wells it is then impossible to raise any spring crop at all.

26. Without going into the very doubtful question of the relative fertilizing powers of canal and well water, it is clear that there are large tracts in these Provinces which are already partly protected by wells. To introduce a canal there would be to sacrifice existing advantages, and to be at the expense of providing a protection for the whole which was only wanted for a part. In such tracts, the whole area would be much more cheaply protected by them than by the introduction of a canal.

27. Another advantage in wells, which can hardly be over-estimated, is the following. It is not necessary to maintain any expensive establishment for the regulation of the water supply, or the collection of dues. Not to dwell on the evils of Government interference with the minute private affairs of its subjects, the financial advantage is obvious. The receipts from canals must pay not only interest on the capital expended, but the cost of establishment. If the same capital outlay per acre were made on canals and on wells, the latter would be cheaper than the former by nearly the whole cost of annual supervision. Supposing

that supervision cost 5 per cent., and interest on capital were reckoned at the same figure, it would be as cheap to spend Rs. 100 on wells as Rs. 50 on canals. If equal sums are spent, the difference goes to the pocket of the cultivator instead of being lost in a purely unproductive expenditure.

28. In his Note on the condition of the Awa peasantry, in which Mr. Crooke sums up the experience he had gained during his management of that estate, he urges more than once that there is no greater practical benefit that a landlord can confer on his tenantry than the extension of well irrigation ; and is a point on which I believe difference of opinion to be nearly impossible.

29. In spite of the recognized benefits, the extension of well construction is as slow now as it was five years ago. It may even be doubted whether the number of new wells is sufficient to supply the loss of those that fall in or otherwise become useless from year to year.

Before a remedy can be applied, it is necessary to know the causes. In its final report to Government on the proposed Bill in 1878, the Board of Revenue expressed its opinion that the main obstacle to well construction was the absence of capital. A second, and perhaps even more fatal obstacle, is the want of knowledge. A third may perhaps be found in the principle which governs assessments on land irrigated from wells.

30. The first obstacle is dealt with by the Takkavi Act, but the experience of many years has shown that whatever simplification in procedure may be adopted, it fails utterly to effect its purpose, and it may be held to be wrong in principle. If the object is worth an effort, and of this there can be little doubt, it is worth while to enquire whether a totally different system to any adopted hitherto would not be found more efficient. The first objection to the present system is the tedious enquiry which must be made before any advance can be sanctioned. This appears to be quite superfluous, as no previous enquiry can secure that the money is properly spent. The proper principle appears to be to attach some small penalty to the failure to spend the money on the object for which it was advanced. The applicant should specify the field on which he proposed to build his well, and the time within which it would be completed. His work would be liable to occasional inspection, and it might be provided by law, instead of being made a subject for specific agreement, that, if he failed to carry out his engagement, the whole sum advanced, plus compound interest, at say, 10 per cent., might be levied at once by any of the processes allowed for the recovery of arrears of land revenue. A mild penalty of this kind would probably be the most effective means of ensuring that the money was properly spent, and if exacted in one case would operate as a deterrent in others.

31. Another objection to the system now in force is that the whole sum must be drawn at once, directly the advance is sanctioned, and interest must be paid on it from the commencement of the undertaking. This makes the loan unnecessarily expensive to the cultivator, who may not be in a position to borrow the whole sum at once, and may prefer to take only so much as he may require as the work progresses. This

difficulty might I think be obviated by the adoption of a plan recommended by Mr. Webb, the zemindar of Baraut in Meerut. There appears to be no reason why, when sanctioning an advance, the Collector should not allow the applicant to open a running account at the Treasury, the whole advance to be taken out not to exceed the total amount sanctioned, interest being charged only on such sums as had actually been drawn, and the zemindar being at liberty to repay so much of the advance as he had taken whenever he found it convenient to do so. The Treasury officer would certify to the Collector the amount of interest due twice a year, once at the first kharif kist, and again at the first rabi kist, and such interest would be added to the Government Revenue. The Collector's order and the Treasury books would be sufficient proof of the advance of any sum, and there would be no need of either bond or registration. At the end of the time within which the applicant had engaged to build his well the account would be closed. If it were found that the money had been misapplied, the whole sum with the penalty would be recovered at once. No great harm will have been done even if occasional instances of perversion escaped the Collector's vigilance. With an officer who took any interest in his work such cases would be very few. There would be no danger of the loss of the money, as, being intended for the improvement of the estate, the loan might fairly be given the priority over other encumbrances.

32. A further advantage from this system would be that the zemindar would only draw just as much as would be required to make the well. It is impossible that he should be able to estimate this correctly before hand, and as advances are now made, he not only pays interest on money before he wants it, but very often, on money which he finds afterwards that he does not want at all.

33. The question of repayment cannot be considered separately from the question of assessment. There seems to be two alternative principles that might be adopted. The first is to consider the land as the sole property of the zemindar, and him solely responsible for its improvement. In that case he would be required to repay the principal sum advanced, as well as interest on it till the date of repayment. The terms for repayment, which appear to me to be most appropriate, are those which I believe are used in the Land Improvement Act for Ireland. Annual payments fixed in such a way that the principal and interest should be extinguished after a long term of years. Tables could be drawn out showing what percentage on the principal would extinguish that, plus interest at say 5 per cent. within given periods. If this principle is adopted, I venture to urge that Government has no equitable claim to any of the advantages which may arise from the investment. It is only as part proprietor that it can advance any such claim, and to assert that, besides the ordinary interest on its loan, which is only to be made on terms which secure it from all pecuniary loss, it has a further title to a share in the enhanced rents, is to claim a right with no corresponding risks or duties. It is in fact to put itself into exactly the same position as it reprobates in the case of worthless landlords, and it should be remembered that be-

sides losing nothing on the money it advances, it will reap the greatest indirect benefits in the stability of its land revenue in the increased prosperity of the people, their increased capacity for indirect taxation, and their security against famine. If this is admitted, the Madras rule that "wells are exempt from assessment" should be adopted. Believing as I do in the extreme short-sightedness of any policy that offers discouragement to well sinking, I would accept this rule without modification, but if any objection were raised, I would urge that the land protected by the well should be assessed at dry rates for, at any rate, the settlement succeeding the date of its construction. The present rule, which leaves it to the Settlement Officer to decide whether the landlord has had enough profit to recoup his original outlay appears to me to be open to many objections, and to operate as a distinct discouragement to well building. In the first place it virtually puts the owner of the well at the mercy of the Settlement Officer, and it is impossible for him to feel any security that his case will be properly considered. His apprehensions, moreover, are not unreasonable, as it is most unlikely that a Settlement Officer should be able to form a correct judgment in the matter. In the second place no one can have read much of the literature of well making without being convinced that it is only under the most favorable circumstances that the enhanced rents secured by a well give as great a profit on the cost of construction as the ordinary market rate of interest for money. As the principal is not extinguished in ordinary investments, but co-exists undiminished with the interest that is paid on it, it cannot be considered that the principal investment on a well has been recovered unless the returns have been higher than the ordinary market rate of interest. Supposing this to be 12 per cent., (for the rate of the native market should be taken, not the rate at which Government can afford to lend,) the Settlement Officer should not decide that the principal had been recovered until the excess annual profit exceeding 12 per cent. amounted to a sum equal to the original investment. It may be doubted whether this would ever be the case, and even then no regard would have been paid to the initial risk. The class of investments should be taken as a whole, and failures reckoned with successes before it would be just to apply the rule. I am therefore of the opinion that the principle recognized in these Provinces should be abandoned, not only because it is unintelligible and distrusted, but still more because it is unfair and inapplicable to the circumstances of the case.

34. The second way of dealing with the recovery of advances for wells would be if the State regarded itself as a joint proprietor in the soil, and jointly liable for the risks, and entitled to the benefits of all investments made for its improvement. The logical action on this premiss would be for the State to assess half the profits on every well immediately it was constructed, and add them to the land revenue, recovering half the original outlay, with interest on outstanding balances till date of repayment. If the borrower preferred to pay half the original outlay at once, all claims on that account would be extinguished, and the State would look, as he does, to the enhanced rents for the profit on its investment. As it might be inconvenient to make an immediate assessment, a fixed rate

of interest by the State might be levied in lieu of its share of the rents till the next settlement.

35. The alternative plans would then be these:—

(1). The whole outlay to be considered as an ordinary debt, in which case the well should be exempted from assessment.

(2). Half the outlay to be considered as an ordinary debt, in which case the well would be liable to assessment. The assessment profits to be commuted for interest on the States' half of the outlay till the next assessment only.

The main difference between the two plans would be that in the second the State would share both risk and profit. It might be found at the ensuing assessment that the value of the well has greatly diminished, and in that case the State would lose; or it might be found that the enhanced rents represented much more than the 5 per cent., or whatever was considered proper interest on the original outlay, or in that case there would be a corresponding profit.

36. Either system appears to be fair; the second may seem a little complicated, but I believe that it would have a chance of being popular, and it at any rate avoids the settlement difficulty. In either case the accounts would be made up, and final arrangements made after the running account for construction had been finally closed. It would then be seen exactly what the well, plus interest during the time of construction, had cost.

37. Two main obstacles, the want of capital, and the inappropriate rules for assessment having been dealt with, the third, the want of knowledge, remains to be considered. The chief ways in which this may be profitably applied have been touched on in the earlier part of this note. They are—

(1). The selection of sites. This is a point on which both Natives and Europeans are at present liable to fatal and wasteful mistakes.

(2). The repair of old wells which have fallen in, and which only require a little engineering knowledge for their re-construction.

(3). The decision as to the best form and size of well. On this point the local knowledge of natives is generally sufficient, but the judgment of European officers not specially versed in well sinking will probably be mistaken.

(4). To overcome mechanical difficulties which are beyond the knowledge or appliances of villagers.

(5). The suggestion of more effective or cheaper forms of well than are known to native science.

38. The chief additions that have already been made to native methods are:—

1. The sand pump for taking borings;
2. Mr. Bull's dredger;
3. The tube well for places where the mota is found, but at a great depth;

4. The percolation wells, for places where no mota can be found;

and as the art has only recently been made the subject of systematic study, there is every reason to hope that even more important improvements may be discovered. The possibilities of percolation wells are still under experiment, which may lead to their almost indefinite development. In this branch native art has stopped short at a very early period of its growth, and though it deals admirably and exhaustively with a small number of well understood conditions, it is unable to cope with circumstances which have remained outside its range, and is baffled by difficulties which are not insurmountable to more original workers.

39. In order to make our knowledge available, and extend it further, it is necessary to maintain a small staff especially devoted to this work. It cannot be expected that it will be possessed by the ordinary District Engineer, who in fact, is generally as little versed in practical well building as any other layman, and until he has made it a special study, has less to teach than to learn from the village well-maker. The staff should consist of one or two Europeans, with a sufficient number of native assistants. The European officers could travel from district to district as their advice was required by Collectors, and would besides be employed in developing practical experiments on a small scale at the expense of Government. The native subordinates would have direct charge of the experiments while the European Engineers were away, or might be lent to Collectors to give instructions where wells were to be sunk by them or by private individuals. The number of applications for assistance which I receive now is more than Mr. Wilson can possibly comply with. If it were known that it were generally available, such applications would almost certainly increase in frequency. If, as I believe a very great stimulus could be given to private well-sinking by more reasonable terms for pecuniary assistance, and the knowledge that engineering aid was obtainable as well, a considerable staff might be employed to the very great benefit both of Government and of the people. The application of professional knowledge would be infinitely easier and cheaper than that of professional supervision. By showing how one well could be made, the construction of a thousand in the same neighbourhood might be rendered possible. The boring for sites could be done by the subordinate staff, and would ordinarily cost as few days as the completion of the well would take months or even years.

40. In connection with a permanent well establishment, Government might maintain a small store of the appliances for well-sinking, such as various kinds of boring tools, dredgers, and perhaps diving dresses, as well as supply iron tubing, if it were wanted, for tube wells.

41. The general conclusions then that are to be drawn from the lessons of the last few years are that of the three requisites for well building: (1), capital; (2), labor and supervision; (3), knowledge; the first can be supplied far more cheaply by the State than by any villager, the second more cheaply by the villager than by the State, and that for the

third the co-operation of the State and the villager is required. I have endeavoured to suggest how these conditions may be best met, that is, by the adoption of a new system of takkavi advances better fitted to the wants of the people, by a revision of the present rule for assessment on improvements, and by the maintenance of a small Engineering staff for the double purpose of investigation and advice. I have not considered this to be the place for detailed proposals for immediate action, but it might be reasonably hoped that if Government would accept these principles, or any modification of them which discussion might recommend, and publish them for the general information of District Officers, and the people, with a distinct assurance of the extreme importance it attaches to this form of agricultural improvement, a strong impulse might be given to the extension of well irrigation, and that instead of retrogressing, as the ruined remains of wells in many districts would lead us fear was the case, or at the best standing still, both the science and the practice might receive an immediate development.

42. It has I hope been made sufficiently clear that no large scheme of compulsory well building can be recommended for the present. But the Court of Wards in both Provinces offer a field where immediate action is possible, and for every reason advisable. When so great a benefit both to the people and to the estate, as well as indirectly to Government, can be secured, it seems unreasonable to be at a loss how to dispose of the accumulated savings of a minority. Wells should be sunk wherever they are possible on Court of Wards Estates, and the only reason, probably, why this has not been done hitherto, is that the Managers feel themselves to be too little acquainted with practical well building to trust themselves to embark on the enterprise without the help of advice that can be depended on. This difficulty can only be overcome by the appointment of an Engineer whose sole business would be to learn the art, and communicate his knowledge and occasional supervision to the estates. If he worked, for the first at least, under Mr. Wilson, he would be able to refer to him in cases of difficulty, and acquire in a comparatively short time the knowledge accumulated in years of painful experiment. This is the more to be desired, as if something of this kind is not done, the whole of this valuable experience will be lost when Mr. Wilson either goes on furlough, or reverts, as it is probable that he eventually must, to the regular line of the Irrigation Department.

43. As further experience is acquired and an adequate establishment is formed, many of the objections which are now fatal to the direct construction of wells by the State may be removed, and it may become a question at some future time whether if land owners refuse terms which are really liberal and decline to protect their estates, Government may not build wells for them and charge them the cost. The want of a trained staff makes this for the present impossible, and until capital were offered to them on reasonable terms by the State, it would be unjust to compel them to pay for the costly supervision of Government officers.

44. There are two points which I have not thought necessary to deal with at length. The first is the distinction between wells as ordi-

nary investments of capital, and as protective works in times of drought. There are large tracts where it is probable that wells might not be remunerative in normal years, though they would prove of the very greatest benefit when the rains were insufficient. It is important to recognize the distinction, but as zemindars are not likely to build, against bad seasons only, wells that would not always be financially remunerative, and as Government has not been recommended, for the present at least, to undertake compulsory construction, it is not likely that any but the former class of wells will be made.

45. The second point is far more difficult, and may require immediate discussion. It is whether the zemindars require greater facilities for raising rents, or the cultivators' better protection for improvements than is given them by the existing law. It is likely that we should be in a better position for forming a judgment when the other obstacles to the application of capital (either borrowed from the State, or belonging to the agriculturist) to permanent improvements have been removed.

46. My acknowledgments are due to Captain Clibborn for the industry which enabled him within a comparatively short time to put together what is probably the largest collection in existence of data for forming a judgment on the probable areas that can be covered by wells of various dimensions, the depth of water required by different crops, the relative cost and efficiency of all the forms of lift in use, and a number of other points on which a clear understanding must be arrived before the practical problem of well sinking can be dealt with successfully.

The Department still has the advantage of Mr. Wilson's services, and it is unnecessary that I should say how highly I value his assistance.

The combined Reports contain a mass of information which I hope may be of help to any one who attempts to sink wells in these Provinces in future.

I have the honor to be,

SIR,

Your most obedient Servant,

W. C. BENETT,

*Director.*

# REPORT

ON

# WELL IRRIGATION IN THE NORTH-WEST PROVINCES AND OUDH.

BY


## CAPTAIN CLIBBORN, B.S.C.,

EXECUTIVE ENGINEER, ON SPECIAL DUTY WITH THE DEPARTMENT OF AGRICULTURE AND COMMERCE.

FROM

CAPTAIN J. CLIBBORN, B.S.C.,

*Executive Engineer.*

TO

THE DIRECTOR, DEPT. AGRI. AND COMMERCE,

NORTH-WESTERN PROVINCES AND OUDH.

*Dated Naini Tal, 15th August*, 1882.

SIR,

I HAVE the honor to forward a Report on Irrigation from Wells as practised in these Provinces in compliance with your demi-official instructions.

You will notice that the results I have arrived at, if correct, show that well irrigation is only profitable under favorable conditions, and there is reason to believe, that in most districts cultivators have already very fully availed themselves of their opportunities, leaving to us now only the doubtful sites to occupy, if we enter in an extended scheme.

There are, however, many opportunities for profitable Government interference in detached situations, and above all in the repair of existing works, to the financial success of which, however, the increase in cost due to the supervising establishment will prove a serious hindrance.

Of all the districts I visited, Bulandshahr presents the most favorable conditions for well enterprise, but detailed enquiry is necessary. I will forward the statistics of the worst villages in the pergannas noted in a few days.

I had intended putting up a series of subsoil water contours with this Report, from which some hints on the causes of the variation in quantity of supply might be expected, but I regret that all the necessary information has not as yet arrived.

I trust to be able to forward them to you in the course of a month.

The recent advances in electricity may prove an unexpected means of famine protection in these Provinces, and the water power of the canal falls could not be better employed, than in lifting water, either from the rivers, for those tracts where wells are impossible, or from wells with a good supply.

From the Note on the Moradabad Wells, it must not be supposed that it is impossible to build wells giving a good supply in pure sand, it is only a matter of expense; if the well rested on a platform of concrete of thickness and area sufficient to support it over the inevitable hollow in the sand below, we would have an admirable imitation of the mota, which should be perfectly successful; the cost, however, of laying such a platform, say 20 feet below water surface, would be considerable, and the necessary area is yet a matter of theory.

I have the honor to be,

SIR,

Your obedient Servant,

JOHN CLIBBORN, CAPT., B.S.C.,

*Executive Engineer.*

# CONTENTS.


| | PAGE. |
|---|---|
| Forwarding Letter, ... ... ... ... ... | i |
| Contents, ... ... ... ... ... | iii |
| Index, ... ... ... ... ... ... | v–viii |
| List of Maps and Plans, ... ... ... ... | viii |
| Introduction, ... ... ... ... ... | 1 |
| The Supply of Water available for Irrigation from Wells, ... | 2–8 |
| Various Methods of Lifting Water,... ... ... ... | 9–12 |
| The Construction of Wells, ... ... ... ... | 13–16 |
| The Cost of Well Irrigation, ... ... ... ... | 17–26 |
| Extension of Well Irrigation,... ... ... ... | 27–29 |
| *Table A.*—Observation and Experiment, ... ... ... | I–XIII |
| *Table B.*—Showing, for 20 Districts, the actual Area commanded by Wells, the area of each crop, the number of waterings required, and the Crop percentages irrigated, ... ... ... | i–xvii |
| *Table B. Abstract.*—Showing Mean Areas and Percentages, ... ... | xviii–xix |
| *Table C.*—Showing Depth of Watering given to various Crops and calculated loss from absorption by watercourses, ... ... | xx–xxvi |
| *Table C. Abstract.*—Showing calculated loss per foot run of watercourses for a working day of 9 hours, ... ... ... | xxvii |
| *Table D.*—Showing periods of Crop growth, mean waterings and intervals, with Abstract, ... ... ... ... | Plates X–XIV |
| *Table E.*—Showing Mean Depths of Waterings per District for nine standard crops, and intervals, ... ... ... ... | xxviii–xxx |
| *Table F.*—Showing Work done in Lifting Water and duty for three standard depths per unit, and for single lifts per man employed, ... | xxxi–xxxvi |
| *Table G.*—Showing the Cost of Irrigation per Acre for every crop watered on the experimental Wells, for a working day of 9 hours, and the number of days required to water the area commanded, ... | xxxvii–lvii |
| *Table G. Abstract,* ... ... ... ... | lviii–lxi |
| *Table H.*—Calculated mean rate per acre for all Crops. Final Statement,... | lxii–lxvii |
| *Table I.*—Relative Cost of Wells if constructed by Government, ... | 14 |
| *Table K.*—Maximum Area which can be yearly irrigated and Interest Rate, | 24 |
| *Table L.*—Total Cost of irrigating an acre of three standard crops, | 25 |
| *Appendix* I.—Experiments to determine the true action of the Mota in Wells, ... ... ... ... | lxviii–lxx |
| *Appendix* II.—Note on the Extension of Well Irrigation in the Secunder Rao Tahsil, Aligarh District, ... ... | lxxi–lxxii |
| *Appendix* III.—Total Work of 34 Wells which were observed during the whole Rabi Season of 1881-82, ... ... | lxxiii–lxxvii |
| *Appendix* IV.—Command of Lagor Wells in Rae Bareli, Oudh, | lxxviii–lxxx |
| *Appendix* V.—Command of Wells, Awa Court of Wards Estate, ... | lxxxi |
| *Appendix* VI.—Examples of Reduction of Culturable Area due to Canals, | lxxxii |
| *Appendix* VII.—Cultivators' Shares in Sitapur Well, Aligarh, ... | lxxxiii |
| *Appendix* VIII.—Cultivators' Shares in Ráth Wells, Hamirpur, ... | lxxxiv |
| *Appendix* IX.—Progress of Moradabad Wells up to 11th May, 1882, | lxxxv–lxxxvii |
| *Appendix* X.—Extracts from Diary, ... ... ... | lxxxviii–xcv |
| *Appendix* XI.—Calculations for Pipe Discharges, ... ... | xcvi |
| *Appendix* XII.—Canal Rates, North-West Provinces, ... | *ib.* |

# INDEX.

## INTRODUCTION.


| | PARA. |
|---|---|
| The importance of well irrigation, | 1 |
| Increase desirable, | 2 |
| Information necessary, | 3 |
| The unit selected, | 4 |
| Cost variable, | 5 |
| Existing statistics useless for purposes of comparison, | 6, 7 |
| Former experiments insufficient, | 8 |
| And misleading, | 9 |
| Experiments how made, | 10 |
| Scope of observations, | 11 |


## THE SUPPLY OF WATER AVAILABLE FOR IRRIGATION FROM WELLS.


| | |
|---|---|
| The water-bearing strata, | 12 |
| Indurated sand and kunkur beds local, | 13 |
| The mota, | 14 |
| When deposited, | 15 |
| Not universal, | 16 |
| General distribution, | 17 |
| All clay beds not mota, | 18 |
| Situation known to cultivators, | 19 |
| From experience, ... | 20 |
| Subsoil sections, | 21 |
| Spring wells, | 22 |
| Artesian action unlikely, | 23 |
| Subsoil water contours desirable, | 24 |
| The curve usually shown by a Doáb Cross Section, | 25 |
| Mr. Beresford's theory of supply, | 26 |
| The "Head," | 27 |
| Artificial imitation of the mota, | 28 |
| Action of land springs, | 29 |
| Result of drawing water from a well resting on fine sand, | 30 |
| Irrigation wells possible in coarse sand or gravel, | 31 |
| Wells in fine sand possible, but expensive, | 32 |
| Advantage of the resistance sand offers to the flow of water, | 33 |
| Variation in quantity of supply, | 34 |
| Percolation wells when used, | 35 |
| Sources of supply, | 36 |
| Sources local, | 37 |
| Bhognipur wells, | 38 |
| Normal level of water surface, | 39 |
| Water surface high in sandy tracts, | 40 |
| Supply from hill rainfall small, | 41 |
| Enquiry into local sources needed, | 42 |
| Artificial sources of supply, | 43 |
| The Agra Canal, | 44 |
| The local supply from Canals small compared with rainfall, | 45 |
| Swamps how formed, | 46 |
| Abnormal fall in water surface a cause of great injury to masonry wells, | 47 |
| How repaired in Muttra, | 48 |

| | PARA. |
|---|---|
| Fall where most observable, ... ... ... ... | 49 |
| Bundelkhand supply, ... ... ... ... ... | 50 |
| „ soils, ... ... ... ... ... ... | 51 |
| No mota, ... ... ... ... ... ... | 52 |
| Surface level generally high on village sites, ... ... ... | 53 |
| Rapid fall in water surface after the rains, ... ... ... ... | 54 |
| Rock wells, ... ... ... ... ... ... | 55 |
| Artificial supply from lakes, ... ... ... ... ... | 56 |
| Canals from lakes not economical, ... ... ... ... | 57 |
| Increase in number of lakes desirable, ... ... ... ... | 58 |


## VARIOUS METHODS OF LIFTING WATER.


| | |
|---|---|
| Cattle lifts, ... ... ... ... ... ... | 59 |
| Lagor, ... ... ... ... ... ... | 60 |
| Kili, ... ... ... ... ... ... ... | 61 |
| Advantages of Kili, ... ... ... ... ... | 62 |
| Distribution of Kili and Lagor, ... ... ... ... ... | 63 |
| Content of lifts, ... ... ... ... ... | 64 |
| Number of units employed, ... ... ... ... ... | 65 |
| Minor economies, ... ... ... ... ... | 66 |
| Advantage of large wells, ... ... ... ... ... | 67 |
| Well fittings, ... ... ... ... ... | 68 |
| Their cost, ... ... ... ... ... ... | 69 |
| Cattle and cost of food, ... ... ... ... ... | 70 |
| Human labor and how employed, ... ... ... ... | 71 |
| Lagor with churrus, ... ... ... ... ... | 72 |
| „ „ gurrah, ... ... ... ... ... ... | 73 |
| Dhenklis, ... ... ... ... ... ... | 74 |
| Rátis, ... ... ... ... ... ... ... | 75 |
| Dhenklis and Rátis when used, and their economy, ... ... | 76 |
| Rates charged for human labor, ... ... ... ... ... | 77 |
| Work done, ... ... ... ... ... ... | 78 |
| The Ráti most economical, ... ... ... ... ... | 79 |
| Continuous motion the most economical for cattle, ... ... | 80 |
| The chain pump, ... ... ... ... ... ... | 81 |


## THE CONSTRUCTION OF WELLS.


| | |
|---|---|
| By cultivators advantageous, ... ... ... ... | 82 |
| Taccavi advances, ... ... ... ... ... ... | 83 |
| Cost of establishment will be heavy, ... ... ... ... | 84 |
| Indirect charges, ... ... ... ... ... ... | 85 |
| Total cost, ... ... ... ... ... ... | 86 |
| Cost of fittings, ... ... ... ... ... ... | 87 |
| Estimate low, ... ... ... ... ... ... | 88 |
| Relative cost of wells if constructed by Government, ... ... ... | 89 |
| Four-lift wells the best, ... ... ... ... ... | 90 |
| Increased depth of water, ... ... ... ... ... | 91 |
| Cost of fittings, ... ... ... ... ... | 92 |
| Cost of lifts, ... ... ... ... ... ... | 93 |
| Interest charges, ... ... ... ... ... | 94 |
| Dry brick wells, ... ... ... ... ... ... | 95 |
| The profit on expensive wells doubtful, ... ... ... | 96 |
| Bricks, ... ... ... ... ... ... ... | 97 |
| Percolation into water-courses, ... ... ... ... | 98 |
| Can be prevented, ... ... ... ... ... ... | 99 |
| Cost of masonry channels, ... ... ... ... | 100 |
| A rate of Rs. 2 per acre necessary to cover cost of construction, ... ... | 101 |

## COST OF WELL IRRIGATION.


| | PARA. |
|---|---|
| Cost variable, | 102 |
| Estimate possible, | 103 |
| Division of cost, | 104 |
| Dry crops, | 105 |
| Interest, | 106 |
| Rabi irrigation, | 107 |
| Periods of crop growth, | 108 |
| Intervals between waterings, | 109 |
| Percentage of crops irrigated, | 110 |
| Days required per watering, | 111 |
| Depth of waterings, | 112 |
| Information in Tables, | 113 |
| The cost by Districts and lifts, | 114 |
| The rabi irrigating season,... | 115 |
| Assumed maximum not reached in practice, | 116 |
| Wells with no rabi irrigation, | 117 |
| Number of wells or units required for a given area, | 118 |
| Sample cases, | 119 |
| Actual figures available, | 120 |
| Difficult of estimation, | 121 |
| Rate must be struck on yearly irrigation, | 122 |
| Rath wells, | 123 |
| Sitapur well, | 124 |
| Cost of kucha wells, | 125 |
| Cost of kucha wells dependent on subsoil, | 126 |
| Wood lined wells, | 127 |
| Annual charges, | 128 |
| Cost of lifting water, | 129 |
| Work done, | 130 |
| Useful work, | 131 |
| Total work, | 132 |
| The foot ton the co-efficient, | 133 |
| Depth of watering, | 134 |
| How varied by subsoil, | 135 |
| Mean depths, | 136 |
| Subsidiary crops, | 137 |
| Depth of damp in soil, | 138 |
| Deep ploughing, | 139 |
| Labor rates, | 140 |
| Net rates per crop, | 141 |
| Calculations for Dhenklis and Rátis imperfect, | 142 |
| Rates lower than those calculated by Major Erskine, | 143 |
| Comparison with canal rates, | 144 |
| The total charge for well irrigation per acre, | 145 |
| Rule for calculating mean rate of watering, | 146 |
| Cost of irrigation for standard crops, | 147 |
| Value of produce, | 148 |
| Opium, | 149 |
| Wheat, | 150 |
| Sugar, | 151 |


## EXTENSION OF WELL IRRIGATION.


| | |
|---|---|
| A rate of Rs. 2 necessary to cover interest on construction, | 152 |
| The calculated area a maximum, | 153 |
| Percolation wells costly to irrigate from, | 154 |
| Cawnpore wells, | 155 |

| | PARA. |
|---|---|
| Moradabad wells, ... ... ... ... ... ... | 156 |
| Interesting as a scientific experiment, ... ... ... ... | 157 |
| Extensive projects not advisable,... ... ... ... ... | 158 |
| The best irrigation in Canal Districts, ... ... ... ... | 159 |
| Tracts with artificial high water surface the best for Government wells, ... | 160 |
| The Bulandshahr District, ... ... ... ... ... | 161 |
| Advances, ... ... ... ... ... ... | 162 |
| How best made, ... ... ... ... ... | 163 |
| Khára wells, ... ... ... ... ... ... | 164 |
| Kyaries, ... ... ... ... ... ... | 165 |
| Decrease in culturable area due to canals, ... ... ... ... | 166 |
| Extracts from Diary, ... ... ... ... ... | 167 |
| Apology, ... ... ... ... ... ... | 168 |


## MAPS AND PLANS.


| | | |
|---|---|---|
| No. | I. } | Diagrams. |
| ,, | II. } | |
| ,, | III. | Map showing roughly the Distribution of the Mota. |
| ,, | IV. | Water Contours, Deoband Doab. |
| ,, | V. | ,, ,, Lucknow to Shekoabad. |
| ,, | VI. | ,, ,, Meerut and Delhi Road. |
| ,, | VII. | Map of Bhognipur Village. |
| ,, | VIII. | Distribution of Kili and Lagor. |
| ,, | IX. | Line of Observation. |
| ,, | X—XIV. | Table D.—Showing periods of Crop Growth, &c. |

# IRRIGATION FROM WELLS IN THE NORTH-WESTERN PROVINCES AND OUDH.

## INTRODUCTION.

The importance of well irrigation.

1. Irrigation from wells has been practised in these Provinces from time immemorial. The subject is one in which Government takes great interest, and justly so, as the area watered is large, and such irrigation in many districts constitutes the only means of bringing a high class crop to maturity.

Increase desirable.

2. There are vast inequalities in the distribution of well irrigation, even in districts in which there is an equal demand for water, and the question which naturally suggests itself to all interested in agricultural improvements is, why not increase the number of wells until districts requiring water have a full command of it?

Information necessary.

3. To answer the above satisfactorily, it is necessary to investigate the following points :—

1*st*. The available supply of water.
2*nd*. „ „ labor.
3*rd*. The cost of irrigation.
4*th*. The area commanded per unit.

The unit selected.

4. The necessity for information on the first three points is self-evident—it is important to know the fourth, as without it we cannot determine the number of wells required for a given area. And it may be here explained that the unit selected is one pair of cattle or men employed actually lifting water.

Cost variable.

5. The cost of irrigating a given area depends on a number of factors—such as depth to water surface, amount and kind of labor employed, situation and crop. For instance, wheat in Muttra requires five waterings, in Moradabad only one; gram is rarely watered more than once, while tobacco often takes ten waterings, and the depth of water given to different crops also varies greatly.

Existing statistics useless.

6. Abundant statistics regarding well irrigation exist, but unfortunately they are of little value in the present instance, as the area irrigated has nearly always been returned per well, and a well is not invariably one unit, but often contains as many as 8; indeed there are instances of wells containing 16 to 20 units.

Ditto ditto.

7. In many examples on which calculations have been founded, irrigable areas were returned as irrigated, and wells which failed to give any useful supply in ordinary years were counted on as capable of a high duty in famine time.

Former experiments insufficient,

8. Again with reference to the quantity of water lifted per day, the experiments have usually been carried on for a short period only, and the day's work calculated by multiplying the result by an assumed number of hours representing the day's work.

and misleading.

9. This method is inaccurate and misleading, for the rate of work on every well, as might naturally be supposed, varies greatly during the day, with the condition of the cattle, the men, and the depth of water. It is always dangerous to calculate large results from small percentages, nor is it unlikely that the Assami will be interested in the result, and attempt deception, which need only be carried on for a short time, and will not seriously interfere with his day's work.

Experiments how made.

10. For the above-mentioned reasons, I determined that the only way to arrive at a just conclusion on the subject of well irrigation was to experiment for the full working day on all classes of wells over a large area, and also to record, personally, as far as possible actual areas irrigated, number of times each crop is watered, and all other details bearing on the subject.

Scope of observations.

11. The Report now submitted gives the result of these experiments, which were carried out in 20 districts of the North-Western Provinces and Oudh, over a distance of 1,200 miles, at intervals averaging 10 miles apart; the line of country covered is shown on *Plate* IX., and it will be seen that it embraces every class of well irrigation, from the first class Kili lifts of Aligarh to the percolation wells of Bundelkhand, and the Dhenkli irrigation of the semi-Terai tracts.*

* *Vide* Table A.

## THE SUPPLY OF WATER AVAILABLE FOR IRRIGATION FROM WELLS.

The water-bearing strata.

12. The sub-soil water supply in the Gogra-Ganges Doáb is, as far as is known, inexhaustible, and nearly everywhere it is at a reasonable distance from the ground surface, but irrigation decreases in a marked manner when the depth to water surface exceeds 60 feet. The water-bearing stratum as a rule is sand, which in most instances is overlaid at varying distances from the ground surface by a bed of clay, indurated sand, or kunkur, called variously "mota," "matbarowa," or "nagasan."

Indurated sand and kunkur beds local.

13. The existence of the indurated sand and kunkur beds is obviously due to local action since the Doáb was first formed; they are met with in but a few isolated localities, and have little bearing on the general question.

The mota.

14. Far different is the case with the clay bed or mota. Where it occurs, wells are always possible, and there are few Zemindars or Assamies in any village who cannot point out with accuracy the site and depth of the layer.

When deposited.

15. The mota was deposited at the period of the formation of the Doáb, and in conjunction with the sand strata, was probably the result of action similar to that which now produces clay beds in the khadirs of deltaic rivers.

Not universal.

16. The mota is not universal; its general distribution is shown in *Plate* III., and there are only a few isolated villages even in the best districts in which it is found everywhere.

General distribution.

17. Referring to *Plate* III., it will be noticed that the mota is not known at all in those tracts directly underlying the hills, and gradually increases in occurrence as the slope of country decreases, it is, however, much more prevalent in the Ganges-Jumna Doáb than in the Ganges-Gogra Doáb.

All clay not mota.

18. The term mota is not applied to all clay strata, but only to those either underlying or directly overlying sand containing water; there are often many such strata of varying thickness and at different depths.

Situation known to cultivators

19. Canals are only a recent introduction compared with wells, which in many districts have been the only means of raising high class crops for a naturally stable community. The accurate knowledge which villagers generally possess of the position of the mota is not, therefore, to be wondered at. It is not universal as might be supposed, but when a cultivator asserts his knowledge it may generally be accepted.

from experience.

20. Their information is of course derived from experience gained in excavating for wells, which have either proved failures, or have been filled up or broken long since. In many cases the memory of the former well has been lost, and I have come across several instances in which new wells have struck on old and long forgotten ones, the sites having been chosen on a tradition of the existence of the mota.

It is curious to note that although the mota may be scarce in a village, if it exists at all the inhabited site will be found on or near it, so placed for obvious reasons, and perhaps the mota may have had more influence on the selection of the sites for great native towns than it is generally given credit for. Amroha and Bareilly may be instanced.

Sub-soil sections.

21. Sections A to G (*Fig.* 1, *Plate* I.) illustrate various conditions of sub-soil found in the Doáb; they might be indefinitely multiplied, as the clay, sand and water occupy every possible relative position.

Spring wells.

22. Leaving out of the question for the present wells which receive a supply from percolation, we will consider the case of what are usually termed spring ("Bom") wells, which should be sunk so as to have the curb or lower ring firmly embedded in the mota, thereby (if a masonry well) shutting out from direct entry all water overlying it. Now the generally accepted theory regarding the use of the mota for water supply is that it acts as an artesian basin, and that the supply entering the well through an orifice which is bored in the clay is a veritable spring,* caused by the pressure of water from the collecting area of the basin.

* Such wells are termed spring in the Tables to distinguish them from percolation wells.

Artesian action unlikely.

23. The facts which are alleged to support this theory are *first*, that until the mota is reached the water supply is easily exhausted. This is contradicted by experience. *Secondly*, that when the hole is bored into the mota a copious supply of water enters the well, often causing danger to the workmen if they do not escape quickly, and sometimes rising above the mouth. But the artesian theory pre-supposes the comparative continuity of the mota, which is at variance with the universal testimony of cultivators, and the facts alleged are easily explained on other grounds, *vide* paras. 26–30. It will also be shown that artesian action is quite incompatable with the strata of the Doáb.

Sub-soil water contours desirable.

24. Although the ground surface of these Provinces has been thoroughly surveyed, and numerous cross sections taken of the ground levels, unfortunately there has been but little systematic attempt to contour the sub-soil water surface, for which, in conjunction with the ground surface levels, we possess unrivalled facilities in the numerous wells, and it is certainly desirable that in future surveys the sub-soil water and the position of the mota should be measured and recorded in a similar manner to the ground surface.

The curve usually shown by a Doáb Cross Section.

25. *Plate* IV. shows the sub-soil water and ground surfaces on a section taken across the Deoband Doáb along the Shamli road, and may be taken as a type. The water surface is at its highest in the centre of the Doáb, and gradually falls in a rapidly increasing slope as it nears the rivers on both sides. The longitudinal slope is one corresponding in some degree to that of the country, and over the whole area in which the so-called spring wells exist; it does not exceed 1 to 2 feet per mile. There is abundant evidence that the water from the high land drains into the rivers on each side at a slope of about 1 in 100, or 50 feet per mile, (it varies according to the nature of the stratum,) and even if the mota were uniformly continuous and regularly overlaid the water-bearing strata, (which it does not,) it is evident that there could be very slight, if any, artesian action. A type section of the mota as it really occurs is shown in *Fig.* 2, *Plate* I.

* Mr. Beresford's theory of supply.

26. The following theory, advanced by Mr. J. S. Beresford, Executive Engineer, Irrigation Department, appears to offer a true solution of the action which takes place.

It is admitted that in new wells when the hole through the mota is first made, a certain quantity of sand is forced up into the well with the water; but after a short time this emission of sand ceases, and if the mota is a good one (3 to 5 feet thick of hard clay) no sinking of the well takes place. A hollow in the sand beneath must, therefore, be formed, and Mr. Beresford assumes that it is of the form (C) shown in *Fig.* 3, *Plate* I., and that the mota merely acts as a platform to support the well over this hollow in the sand, which gives a surface large enough to discharge a supply corresponding to the head given.

The "Head."

27. The head is the difference of level between the water inside and outside the well, for when water is drawn from a well the surface reduces more or less rapidly according to the quantity drawn out and the strength of the supply, and at length a point is reached when the water vacuum is just sufficient to draw in a supply equal to the quantity taken out. This is the mean head, it naturally varies a good deal over the Doáb, and can be found for any of the experimental wells by deducting the figures in column 67 from those in column 66, Table A.

Artificial imitation of the mota.

28. This theory is well supported by facts familiar to Engineers experienced in laying foundations below water surface on sand, where these consist of a platform resembling the mota. If any flaws exist, after a slight primary emission of sand, nothing but clear water is discharged, and no damage to the foundation occurs, provided the platform is thick and strong enough to act as a beam over the hollow in the sand below. The size of the hollow will be modified by two conditions:—

1. The head, which regulates the quantity of discharge.
2. The comparative fineness of the sand, which regulates the rate of discharge.

The coarser the sand the smaller will be the hollow. Perhaps the best idea of the area required to admit of the delivery of a given quantity of water in a given time may be obtained if we represent the spaces between the particles of sand by the holes in fine wire gauze of varying gauges. Coarse netting will require a smaller area to admit of a given discharge than fine netting.

Action of land springs.

29. Similar action may be observed by any one curious enough to examine the *true springs* when the sub-soil water escapes at the junction of the bargar and khadir. On the

* *Vide* Appendix I.

banks of our large rivers the khadir from A to D will usually be covered with a clay deposit over sand, and the springs burst out at A, *Fig.* 4, *Plate* I., and flow into swamps between A and D, or to the river direct. A sort of cup or hollow is formed, *see* B, in which the sand bubbles up with the force of the spring, but when the area of the surface of the hollow is large enough to discharge the water supply, nothing but the very finest sand is carried away.

Result of drawing water from a well resting on fine sand.

30. If a well rests on sand alone when water is drawn, abstraction of sand takes place from below, and the well being a heavy body sinks into the hollow. The effect of drawing water from a well in pure sand is to drain an inverted cone, the height of which is represented by the depth of the well below water surface, the steepness of the sides varying directly with the fineness of the sand stratum, *Fig.* 5, *Plate* I.

It will be seen that the content of the cone increases with the depth of the well below the percolation level.

The water nearest the well is first drawn into it, and passing vertically down close outside, draws the sand with it into the well, and if the process is continued long enough, the sand will eventually rise into the well until nearly level with the water outside.*

Wells possible in very coarse sand or gravel.

31. The results described will only occur when the quantity of water drawn from a well is greater than the surface exposed, *i. e.*, the area of the bottom of well can deliver. There are wells on the margins of the Bundelkhand lakes which give an ample supply from fine gravel, and which correspond in every point with the example above described, except that the intervals between the particles are greater.

Wells in fine sand possible but expensive.

32. There is no difficulty in designing a well which would work successfully in pure sand of any fineness, it is only necessary to make it large enough; but the expense in the strata usually met with in the Doáb would be enormous, and as far as practical irrigation is concerned it is out of the question.

Wells resting on pure sand are constantly used for drinking purposes without any injury to their stability.

Advantage of the resistance sand offers to flow of water.

33. For the *ordinary cylinder* well it is therefore evident that the *existence of the mota is a necessity for its success*† as an irrigating medium, and it is worth noting that but for this very resistance which sand offers to the passage of water, irrigation wells would practically be impossible in the Doáb, for the sub-soil supply would drain away to the lowest point; its contour would be a nearly level line between great rivers, and the depth to water on the watershed, which is now the least at the tablelands, would be a maximum.

Variation in quantity of supply.

34. There are great variations in the quantity of water capable of being drawn from wells close together and apparently similar in all respects, but the explanation is simple enough when we remember that the area of the mota must have a similar effect to an increase in the depth of the well in enlarging the diameter, and consequently the content of the drainage area (*vide Fig.* 6, *Plate* I).

Percolation wells when used.

35. Percolation wells are used under the following conditions:—

(*a*). When the mota does not exist.

(*b*). When it does exist but is at such a depth below water surface that it is too expensive or too difficult for the people, with their existing means to reach it.

(*c*). When wells resting on the mota become injured from various causes.

(*d*). When they pay better than mota wells. Water enters a percolation well by filtration from the sand, either through crevices in the wall of the well, or through a grass or twig lining, which admits the water while holding the sand back. Such wells are generally found in the khadirs and low-lying lands, where recent diluvial action has washed away the former strata, replacing them by nearly pure sand. On the outskirts of the town of Jalalpur, (Shahjahanpur District,) there is a curious instance of this action. For miles round, the Ramganga, which is a great wanderer,

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* *Vide* Moradabad well experiment.

† Natural or artificial.

has cut away the old strata and the mota is unknown, except where a kunkur stratum exists in a small patch of 16 acres in extent, which is crowded with no less than 14 kucha wells, some of them 100 years old —all worked with Rátis, a class of lift not much used elsewhere in the pargana. Percolation wells are also extensively scattered over the districts lying under the hills, where, as before noted, the mota is rarely found, and as (in common with the khadir) such lands require little water compared with the more southern districts, there appears to exist a sort of balance of power regarding the facilities for irrigation in the various tracts of the Doáb.

With reference to the four conditions under which percolation wells are used, *Case* (*a*) is self-evident; *Case* (*d*) will be dealt with when the cost of irrigation is considered.

*Case* (*b*) occurs—

1*st.* In villages, most parts of which possess a good mota easily obtainable, but certain other areas have the mota either at a greater depth or overlaid with quicksand, and the people, accustomed as a rule to dig wells with facility, magnify to themselves the difficulties to be met with in these isolated areas, which, in less favored villages, would be considered serviceable.

2*nd.* When the mota is at such a depth that the Capital outlay would leave no margin for profit.

3*rd.* In areas where the mota is overlaid with sand formerly dry, in which kucha "Bom" wells were the rule, but where now, from a rise in water level, the sand has become saturated, and the people are unable to reach the mota simply because they cannot dig through the wet sand. In the 1st and 3rd cases the advantage of Government interference is obvious, advice and regulated advances would be invaluable.

*Case* (*c*) occurs—

1*st.* When the mota is thin. If the well is overworked the supply of water will increase, but so will the hollow under the clay, and eventually becoming too large for the thickness of the mota, the well drops through and is practically ruined. This occurs frequently in *famine years*, when good wells are strained to the utmost. Fortunately there is often a second layer some distance below, and were advice and assistance afforded, many pitiable examples of wasted capital could again be made profitable.

Cultivators are frequently well aware of this danger, and will refuse to allow a second *churrus* to be used, although apparently the supply in the well is ample.

2*nd.* When the well gets broken below, and the owner is afraid to clear it out and re-open the mota. These cases are quite remediable in most instances, but often are beyond the powers of the owners.

3*rd.* When through carelessness the well is allowed to get filled with débris and a small supply only filters through. This is scarcely a case of enforced percolation, and occurs mostly in those canal-irrigated villages, when the water surface has been so much raised that such a well will suffice for the irrigation of a small plot of opium or garden produce.* In cases like this it would appear advantageous to reserve the canal supply for less favored localities.

4*th.* When the sub-soil water falls below the mota. This does not invariably result in the well becoming percolation. Often as before mentioned a second mota exists, and if it can be reached the well may be underpinned, and a fresh supply obtained from the lower layer, for its stability is in no way endangered as it rests on the mota above. If, however, no lower mota exists, or if it is at a great distance, the cultivator can only dig a hole in the sand below, line it with grass and obtain a small and intermittent supply, the end is generally the destruction of the well, as the mota is gradu-

* Cultivators in canal villages often keep up a sort of home farm round the well to employ their cattle on, and opium is a favorite crop, as it requires frequent and thin waterings.

ally undermined, from the abstraction of the sand by the bucket, and it has also lost the support given by the water formerly below it.

Sources of supply.

36. It is somewhat difficult to understand how the rain water, which naturally must be the main source of the sub-soil supply, finds its way below the surface. Experiments made after heavy falls on plateaus show that the depth to which water penetrates directly into the soil is not great; it varies from a few inches to as many feet according to the nature and level of the surface, and from the sub-soil water contours we see that the rivers even in heavy flood can have little or no effect.* Practically what we want to determine is the source of the supply in the higher levels, *i.e.*, AA of any Doáb cross section, *Fig.* 7, as these must be nearest the source, the lower levels clearly being the result of slow drainage towards the rivers on either side. That this drainage is very slow is both certain and fortunate; certain, because we know that the level in wells even in years of excessive drought falls a few feet only compared with the great difference of level which exists between the surface of the water at the centre and the edges of the Doáb; for instance, in the section of the Deoband Doáb before referred to, the difference of level is 16 feet in a distance of $1\frac{1}{2}$ miles, which is a comparatively flat slope, but we have no record of any fall in wells near this approaching 16 feet. The resistance to drainage is fortunate, as without it the contour would assume the direction of the dotted line CC, (*Fig.* 7, *Plate* I.,) which in many districts would be fatal to the interests of well irrigation. That the rainfall does not filter evenly down from the whole surface exposed may be accepted as evident, but there are great variations in the nature of soils, and any cursory inspection of a map will show the watershed intersected with jhils and hollows, the majority of which undoubtedly have clay beds, but in many the soil is more or less porous.

Sources local.

37. This assumption of local and isolated filter beds is supported by the fact that the rise of water in wells is most marked in some villages, while there is scarcely any yearly variation in others, and in all the water usually resumes its normal level by the end of the cold weather.

Bhognipur wells.

38. A good example of the effect of the water in tanks on wells is found in the Bhognipur village, Cawnpore District, the plan of which (*Plate* VII.) shows a marked variation in depth according to the positions of the wells with reference to the various village tanks.

Normal level.

39. It has been noted that the sub-soil water will practically stand at a slope of 1 in 100, but it must be remembered that this is when it has an outlet, even though the quantity discharged may be small; if no escape is possible and the supply is cut off, the surface must assume a much flatter slope in time.

Water surface high in sandy tracts.

40. Accepting this theory of local sources of supply, we ought to find a high surface level in sandy tracts indifferently supplied with the mota; and the Hasanpur pargana of the Moradabad District is a good example, as there the water level is found at 10 to 15 feet from the surface.

Supply from hill rainfall small.

41. The rivers taking their rise from springs near the hills and the Terai streams carry off a fair share of the rainfall which has been absorbed by the hills. The nearer tracts may be partly fed by the hill rainfall, but it is difficult to imagine the great length of the Doáb to be supplied from such a source; it indeed appears impossible, when we remember the way in which the Doáb is cut up by deep streams often heading the drainage.

Enquiry into local sources needed.

42. The Doáb rainfall must, therefore, be credited with the natural supply of sub-soil water above the mean level of streams, and an enquiry is much to be desired into the local sources of supply, the amount of water held in suspension, and the curves which it assumes under different conditions.

Artificial sources of supply.

43. The artificial supply is obtained mainly from canals, it is, however, local. Permanent sections of the canal are rapidly silt-lined, which forms a good watertight medium, and great attention has for some years been given to fixing gradients which will avoid either errosion or heavy deposits. When percolation occurs, the distance is limited by the abrupt slope which the water assumes, and the amount by the fact that canals are usually carried along the watershed where the sub-soil surface is highest, *see Fig.* 8, *Plate* I. and *Plates* V. and VI.

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* In the Deoband Doab the sub-soil contour is 5 feet higher in the centre than the maximum flood level in the rivers on either side, and higher up every Doáb the excess is much greater.

The Agra Canal.

44. The Agra Canal affords a good example of this action; the water surface has been raised in a gradually decreasing amount as the distance from the canal increases, and at an average distance of half a mile the influence is unfelt.

The local supply from Canals compared with rainfall small.

45. That the influence of the canal in raising sub-soil level is small compared with rainfall is well shown by a section, *Plate* VI., prepared by Mr. W. Willcocks, Executive Engineer, in 1879, which was a year of excessive rainfall, while 1877, also shown, was a year of drought, in which the canal was constantly run with a full supply. The section was taken along the Meerut and Ghaziabad road, which runs nearly parallel to the canal and drainage lines, and is therefore no guide, unfortunately, to the transverse slope of the sub-soil water surface.

Swamps how formed.

46. Swamps are formed by percolation from canals when the level of the ground surface intercepts the line of water slope, and also when the slope is flattened by an intercepting bed of clay, in both instances puddling the bed would be a more efficient remedy than drainage, which increases the quantity of the water percolated, *Fig.* 9, *Plate* I.

Abnormal fall in water surface a great injury to masonry wells.

47. Drought, as might be expected, has a marked influence on the sub-soil water level in tracts of extended well irrigation when there is no artificial supply.

In some parts of the Muttra District the fall in water surface amounts to from 15 to 16 feet during the last five years, and it has injured a number of wells, as in some instances the water has fallen below the mota.

There is a possibility that the marked and, as far as irrigation wells are concerned, destructive fall of water surface in the Muttra District, has been partially caused by over drainage in the Aligarh District. A glance at the Map will show that the parts of the Aligarh District which have been most effectually drained, were probably the local collecting areas which kept up the sub-soil surface in the tracts now suffering in Muttra, where there are comparatively few jhils, and the fall occurred just about the period at which the drainage system was perfected.

A satisfactory explanation of this, and other interesting matters relating to the sub-soil supply, can only be obtained by carefully observed sub-soil water contours, and the subject of a complete Map of the North-West and Oudh water levels has been brought to the notice of Col. Forbes, the Chief Engineer for Irrigation, and has received his approval as far as the preliminary arrangements are concerned.

How repaired in Muttra.

48. The Assamies have repaired some wells in an ingenious manner by underpinning the masonry with a wooden or a grass lining. An interesting example of this is No. 6618, village Bheema, pargana Mahaban, *Fig.* 10, *Plate* I.

Two-lift well, old. Water surface has fallen 12 feet during last 5 years. For 4 years the well was kept at work with a grass lining, last year a wooden lining was put in. This well cost Rs. 400, and though built with lime, is now showing signs of giving way. The present supply is percolating through the sides of wooden lining or *kothi*.

Where most observable.

49. The following accounts of the abnormal permanent fall of sub-soil water level were supplied by Assamis in the field, and in all cases the fall had caused injury to the wells—

| District. | Pargana. | Village. | Fall in feet. |
|---|---|---|---|
| Aligarh, ... ... | Hathras, ... ... | Sasni, ... ... | 6 |
| ,, ... ... | ,, ... ... | Hathras, ... ... | 4 |
| ,, ... ... | Iglas, ... ... | Iglas, ... ... | 6 to 8 |
| Muttra, ... ... | Saadabad, ... | Munsia, ... ... | 6 |
| ,, ... ... | Mahaban, ... | Mirhouli, ... ... | a few feet. |
| ,, ... ... | ,, ... ... | Raya, ... ... | 15 |
| Shahjahanpur, ... | Pawaine, ... ... | Dharmangatpur, ... | 5 |
| Unao, ... ... | Unao, ... ... | Unao, ... ... | a few feet. |

Bundelkhand supply.

50. In Bundelkhand the sub-soil is not uniform as in the Doáb, the mota is unknown, and supply varies greatly according to locality, both in quantity and depth below the surface of the ground.

Soils.

51. The soils of Bundelkhand and their characteristics are well known; they consist of "mar," "kabur," "parwa," and "rakar." Mar usually overliesthe parwa and rakar, the exposure of the surface of which is supposed to be the result of denudation. In the more northern tracts of Hamirpur the direct rainfall appears to be the source of the sub-soil water supply, which has a better chance of filtering down than in the Doáb, owing to the undulating nature of the country.

No mota.

52. The absence of the mota overlying sand charged with water, deprives Hamirpur of the ample supply generally obtainable in the Doáb. But there are local spots where a very good supply is obtainable, and nearly all the large villages have a fair area of garden cultivation which is irrigated.

Surface level generally high on village sites.

53. The depth to water surface is usually less on the inhabited sites than in the village "har," or outlying cultivation, (*Fig.* 11, *Plate* II.,) and this is explained by the fact that the villages are always from choice placed on parwa soil. Mar being considered feverish, and rakar bad for cultivation. Denudation of mar, of which parwa is commonly the result, would naturally take place first from the highest points of the general surface of the country; the village will, therefore, usually be on a relatively high point of the sandy or water-bearing strata, and consequently near the water.

Rapid fall in water surface after the rains.

54. Although after the rains and during the cold weather the supply is fairly plentiful, yet in many places by the beginning of the hot season it becomes much reduced, and wells frequently dry up. This appears to be due to the coarser nature of the soil, which permits of purely percolation wells being used, *vide* para. 31, but the water can also assume a much flatter slope to the drainage on either side. Deep wells would appear to be the only remedy, but the point to which they should be sunk must be locally fixed, as the water falls below the beds even of the drainages in many instances.

Rock wells.

55. In the southern parts of Hamirpur rock wells are common, the overlying strata are soft and dry, and the wells are sunk into the solid rock, the water gradually increasing in quantity with the depth. The supply is always precarious, and seems to be derived by percolation from fissures in the apparently solid rock.

Artificial supply from lakes.

56. The Bundelkhand lakes are caused by obstructions placed across the natural drainage outlets, where the slope and conformation of the country is suitable for the formation of reservoirs. Direct irrigation is practised from many of them, but is precarious, being dependent on the previous rainfall. Nor is it practised with that economy which the known limitation of the supply and the cost of artificially raising it should enforce.

The beds of these lakes are porous, often owing to the proximity of the hills, much mixed with gravel, and the supply spreads freely through the strata surrounding the lake, and it is here we find the best well irrigation in Bundelkhand. Even when the lakes dry there often remains hidden under the surface a copious supply which is distributed by the cultivators on the most economical principles.

Owing to the short depths to water surface and the coarse nature of the soil, wells can be cheaply built, and the cost of lifting is small.

Canals from lakes not economical.

57. The question of entirely stopping direct irrigation from these lakes is certainly worthy of consideration. The area capable of being irrigated would *certainly* be much increased from the enforced economy, and it is probable that the sub-soil supply would outlast even two years of drought if the lakes were not reduced by directly drawing water from them.

Increase in number of lakes desirable.

58. Even small lakes scattered over the country would be of the greatest benefit, and the capital saved by the omission of the canals might be devoted to the assistance of the Zemindars in building wells, on which a rate could be charged sufficient to cover the outlay.

## VARIOUS METHODS OF LIFTING WATER.

Cattle lifts.

59. In the Districts examined, except in a few isolated instances, cattle are only employed on what are called the "Kili" and "Lagor" systems, in both of which the *churrus*, or leather bag, is drawn up filled with water by a strong rope fastened to a wood or iron ring, round which the edge of the *churrus* is tied; the rope is carried over a pulley fixed on a framework overhanging the well mouth, and the cattle travel up and down an earthen ramp, sloped at an angle varying from 5 to 20 degrees. The *churrus*, or *pur*, as it is often called, when emptied by a man standing at the mouth of the well is again lowered down into the water and refilled.

Lagor.

60. When working Lagor there is only one ramp or slope, and when the *pur* is emptied the bullocks turn round and walk up the slope with the rope still attached to the yoke.

Kili.

61. The term Kili is derived from *kil*, a nail or peg of wood, and when cattle are worked in this system, as soon as the *pur* is empty the driver takes out the peg which fastens the rope to the yoke, and holding the end of the rope in his hands, allows the weight of the *pur* to draw him up the ramp A (*see Fig.* 12, *Plate* II.) The bullocks walk up a second parallel ramp B, to a feeding trough C, fixed near the top of the working ramp, and as soon as the *pur* is re-filled are again ready for work.

Advantages of Kili.

62. The advantages of Kili working over Lagor are that it does not harass the bullocks, it is easier on the driver, and it enables a number of cattle to be used at the same time, thereby saving delay and expense. Any one who has observed cattle worked Lagor will be well aware of the irritation caused by the jerks their necks get when the empty *pur* is thrown back into the well, nor do they get any food when working. It is easier on the driver, as he gets pulled up the ramp, and it saves time and expense, since two to four pairs of cattle can be employed at the same time, each pair waiting their turn. When the cattle are well trained only one driver is necessary, as the food near the well attracts them. The driver goes up the ramp much quicker than cattle do, and therefore more work is done in the time, one pair being always ready to lift. In both systems the driver usually sits on the rope going down.

Distribution of Kili and Lagor.

63. The distribution of the Kili and Lagor systems is shown in *Plate* VIII.; it is curious that it should be so local, but except on the boundaries, the systems are absolutely un-mixed, and this although the great advantages of Kili working are admitted by most cultivators who know it.

Content of lifts.

64. The capacities of the various lifts are given in Table F., and it is interesting to note the difference in content. Lagor lifts vary from 1·50 cubic feet in Hamirpur to 5·70 cubic feet in Farukhabad, and Kili from 2·70 in Bijnor to 7·65 in Muttra. The latter weighs, filled with water, no less than 500 lbs., and requires very powerful cattle.

No. of units employed.

65. At Kili wells the same cattle are employed throughout the working day, but at Lagor, when more than one pair is used, the change is made at noon, and it is rare to find more than two pairs used. At Kili, however, three pairs are not uncommon, and for sugar cultivation four pairs are often used; the reason of this is that the cattle are employed crushing sugarcane up to the last day to which the Assami's can put off getting in their sugar, when all combine to water the area, which is never large compared with the rabi irrigation.

Minor economies.

66. Besides the main divisions into Kili and Lagor, there are many minor differences in the manner in which wells are worked, some of which have a considerable bearing on the expenses.

In a single *pur* well with one pair of cattle three persons are employed—one driving, one emptying the *pur*, and one in the field adjusting the depth of the supply and clearing the

water-courses. In cases when an Assami's family work with him, his wife empties the *pur* and one of the children attends to the fields.

When two lifts in the same well are used there is at once an economy, for it only requires at most two persons more, and so on for any number of lifts added, as one man is quite sufficient to attend in the fields to more water than any well could supply.

But various other economies can be practised. If the ramps are parallel and the pulleys on the same side of the well, one man can empty two *purs*, or one man can drive two pairs of cattle even at Lagor; but these unfortunately cannot be practised together, as there would be a loss of time in emptying if the lifts came up together.

For two lifts on the same side a large well is required, and we therefore usually see this system employed in four *pur* masonry or in good kucha wells.

The following table shows the number of persons required to work different classes of wells under the best conditions:—

| No. of Lifts. | One *pur*. | | | | Two *pur*. | | | | Three *pur*. | | | | Four *pur*. | | | | Six *pur*. | | | | Eight *pur*. | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Pairs of cattle per *pur*. | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 |
| Kili, ... | 3 | 3 | 3 | 3 | 5 | 5 | 5 | 5 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 10 | 10 | 10 | 10 | 13 | 13 | 13 | 13 |
| Lagor, ... | 3 | 3 | ... | 5 | 5 | 5 | ... | ... | 7 | 7 | ... | ... | 7 | 7 | ... | ... | 10 | 10 | ... | ... | 13 | 13 | ... | ... |

Advantage of large wells.

67. The economy of large wells and Kili *in this respect* is manifest, for the eight *pur* well with four pairs to each *pur* should be equal to 32 one *pur* wells, which would require 96 men, but as will be shown further on when the number of pairs on one *pur* is unduly increased their efficiency is diminished.

Well fittings.

68. The fittings of wells are very simple; they vary much, however, in different districts. The two main types are shown in *Fig.* 13, *Plate* II. A is used mainly for kucha and B for masonry wells.

Their cost.

69. These fittings rarely cost any actual cash. The wood is generally the cultivator's own, and the making and repair is included in his general contract with the village carpenter. What he has really to pay for are the pulley, the material for rope, which is itself home made, and the *churrus* or *pur* with its ring.

The cost of the fittings and lifts for each well is given in Table A, columns 44, 47; they are of necessity in a few cases approximate, but as a rule have been placed at the lowest possible figure, and represent as nearly as can be actual outlay.

The cost of the pulley and ring is included in capital, but the *pur* and rope are renewed yearly in fully worked wells. The cost varies as follows:—

| | | | | |
|---|---|---|---|---|
| *Churrus* or *pur*, | ... | Rs. 3 to Rs. 9 | according to size. | |
| Ring for *churrus*, | ... | As. 2 to „ 1-4 | „ | to size and material. |
| Rope „ | ... | „ 8 to „ 2 | „ | length and quality. |
| Wheel „ | ... | „ 2 to „ 3 | „ | quality. |

Cattle and cost of food.

70. The value of the cattle employed varies from Rs. 10 to Rs. 60 per head, and their quality has an important influence on the quantity of water drawn daily. An average rate of 3 annas per pair has been charged as the cost of feeding bullocks when working; this is less than the actual cost in the case of large bullocks, and perhaps slightly more than incurred for inferior classes. But good bullocks will work more days in the month than bad ones, and some small expense for food is necessary even on idle days. No addition to capital has been made to cover the purchase of cattle; it is certainly doubtful whether they are ever purchased directly for irrigation, and the rate charged is intended to cover not only the food, but also the interest on share of original purchase money and depreciation.

Human labor and how employed.

71. Human labor is employed in four ways for lifting water in the districts examined—

1*st*—As cattle Lagor—drawing with a *churrus*.
2*nd*— „ „ „ a *gurrah* or earthen pot.
3*rd*—The "Dhenkli."
4*th*—The "Ráti."

Lagor with *churrus*.

72. (1) is common in Lucknow, Hardui, Shahjahanpur, 10 men being employed according to the depth of the well and the size of the lift. As in cattle-worked wells, one man is in the field, one emptying the *churrus*, and two-thirds of the balance pulling the rope, one-third resting.

I have never seen wells worked with more than one *churrus* in this manner, the content of the lifts used is small, from 1·5 to 2·5 cubic feet, but coolies work much faster and for a longer time during the day than cattle.

The cost of fitting is similar to that for Lagor wells.

Lagor with *gurrah*.

73. (2) I have only seen in Unao, one to two men are used pulling on the rope, one emptying and one in the field. This method is employed either when cultivators are very poor and cannot afford any more expensive arrangement, or when the supply is scanty and at a distance of 20 feet or more from the ground surface.

It is most expensive, the cost of two persons in attendance being often incurred on one man drawing water. Changes from one class of work to another are, however, frequently made, which somewhat increases the quantity of work done.

The cost for fittings is very small.

Dhenklies.

74. (3) Dhenklies are well known, they are universal in the East, and consist of a lever, the short end of which is loaded so as to a little more than counterbalance the weight of the rope and empty earthen pot on the long end. One man is employed lifting and emptying and one person in the field, and they change work occasionally.

It will be seen that the man working the Dhenkli has to pull slightly on the rope to lower the *gurrah* into the well, but when raising he has to exert less force than the quantity of water lifted would require, and neglecting the friction on the axis, there is no loss due to dead weight if the loading is properly adjusted. When the supply admits of it, two Dhenklis in one well are common, and thus the labor of one person is saved. 10 to 15 Dhenklis are often seen in different wells close together lifting into a common water-course; this usually occurs when a good local supply near the surface is available, and it is a most economical system of irrigation.

The cost for fittings is small—two uprights of wood or earth are used to support the axis of the lever, which is a 20 to 30 feet pole, the length varying with the depth of the well. When such long poles are not obtainable in one piece two are joined. Re. 1 for first cost and 8 annas for repairs during the season, will cover the expense of a single lift.

The Ráti.

75. (4) The Ráti or *charki* (*Fig.* 14, *Plate* II.) consists of a rope passing over a light pulley fixed in a framework over the well; the rope has an earthen pot attached to each end, and the man working pulls them alternately up and down. As with the Dhenkli there is no loss due to dead weight lifted, and this class of lift is employed in similar circumstances, but its range is much more limited. The cost for a Ráti is as follows:—

| | | | |
|---|---|---|---|
| Pulley, | ... | ... | Re. 0-14-0, lasts 5 years. |
| Uprights, | ... | ... | „ 0- 2-0 „ „ „ |
| Rope and *gurrahs*, | ... | ... | „ 0- 4-0 to 0-8-0, lasts 1 year. |
| | | Total | „ 1- 8-0 |

Dhenklis and Rátis when used, and their economy.

76. Dhenklis and Rátis are used as a rule in cases where the sub-soil consists of pure sand, or strata such as only give a small and intermittent supply, and when the depth to water surface does not exceed 20 feet.

The wells in which they are used are nearly always kucha, and if lined, only with a mat or rope of grass, which just suffices to hold the sand back and to keep the cavity in the centre open enough to allow the small *gurrah* to be filled. The quantity of water drawn is so

small, that the surface even in pure sand percolation wells is often not sensibly lowered, so that when the sub-soil surface is met with, at say 10 feet from the ground level, the Dhenkli continues drawing water at from 11 to 12 feet during the day. This influences in a marked degree the actual cost of irrigation, and when time is not an object, it appears difficult to improve on the Dhenkli in such a situation. If the supply is so bad that even the slow abstraction by the Dhenkli exhausts it, the Assami is equal to the occasion, for he halves the expense by only employing one man at the well, who alternately draws water for a short time, and then distributes it by opening the compartments in the field, thus allowing time for the supply to accumulate in the well.

Rates charged for human labor.

77. In calculating the cost of irrigation, the rates for the men employed have been entered in the case of hired labor at those actually paid; these vary according to the situation of the village with reference to large towns, and from other causes, such as relationship, age and class. They have been obtained by careful enquiry. In some cases cash payments are made, in others only food and clothes are given; the latter have been worked out at current rates. Home labor has been charged at one anna per head per working day, deducting one man from the total number employed. This represents the cost of food and clothes, and although it is possible for a man to live on less, yet the labor is severe, and the allowance can hardly be considered excessive.

Work done.

78. Table F. shows the work done with the different classes of lifts. It will be seen that in the case of cattle it increases in quantity with the depth of the well, or in other words with the continuity of the labor. It does not vary with men, as they can turn quickly, and in the case of cattle is reduced when the number of bullocks is unduly increased.

The gross work done by one man equals half ton lifted one foot in one minute; for cattle the amount varies from a half to 3 tons per head according to quality of cattle and depth to water.

The Ráti most economical.

79. The Ráti is the most efficient and economical lift for all depths up 20 feet, but men unused to it do not like the labor, and the quantity lifted is small, and it is therefore unsuitable for thirsty tracts, nor is simple coolie labor always available in quantity. Cattle form the staple labor of the country, and it is therefore with reference to them that the question needs most enquiry.

A continuous motion the most economical for cattle.

80. A continuous motion giving the best results, the natural conclusion is that the cattle should walk round the well, but to make the motion continuous with the ordinary intermitted lift, necessitates such a complication of fittings and ropes, that the gain is more than compensated for by the increased expense and loss of time in adjustments. The chain pump has now been brought to a high state of efficiency at the Cawnpore farm, and it is to it that we must look for the most economical distributions of water from wells in quantity.

The chain pump.

81. A continuous motion can be given to the chain of the pump from the bullocks walking round the well by simply lengthening and carrying it round a horizontal drum revolved directly by the bullock pole, the chain being guided by a pair of small wheels tangential to the circumference of the drum, *Fig.* 15, *Plate* II.

The whole arrangement would not cost more than Rs. 20 over the first cost of the pump.

A pump and fittings complete fit for a pair of cattle could probably be supplied from the farm for Rs. 100, and the interest on this at 6 per cent. would not be equal to the yearly charge incurred by Assamis for their lifts, *viz.*, Rs. 8 to Rs. 12.

There is some uncertainty as to the maximum speed at which chain pumps may be safely worked. If it is found desirable to increase the speed, the apparatus above described can be easily adapted by adding a second driving wheel, and taking off the power with a chain, *see Fig.* 16, *Plate* II.

## THE CONSTRUCTION OF WELLS.

By cultivation advantageous.

82. The cost of wells when constructed by cultivators has been given in Table A., and the great advantages of home construction by men, so much interested in the result, and so well acquainted with local facilities, need not be further remarked on. When I mentioned the subject of well construction to zemindars and cultivators, they always expressed a wish to do the work themselves, provided the necessary advance could be had on simple terms.

Taccavi advances.

83. Their dislike to the present taccavi system must be strongly founded when the difference between the Government rate of interest and that charged for Mahajan's advances is considered; a curious instance of their dislike to taccavi on any terms occurred in Aligarh, for though the advance was offered without any interest to the cultivators of the land thrown out of canal irrigation in the Secunder Rao Tehsil, it was frequently, if not invariably, refused. The wells were built, however, and irrigation carried on, and it is possible that the absence of an advance was not much felt, as cultivators in canal villages are generally well off.

Cost of Establishment will be heavy.

84. If wells are built by Government they will have to bear the cost of the supervising establishment, which will be heavy, as the work is necessarily a good deal scattered, and small isolated works cost relatively more in this respect than large ones.

Indirect charges.

85. The following are the indirect charges which will be incurred in any extended scheme of well construction by Government agency:—

| | | |
|---|---|---|
| Establishment, | 20 per cent. on works, | this is according to Government of India orders founded on experience. |
| Leave and Pension, | 20 per cent. on 85 per cent. of establishment, | |
| Interest during construction, | at 4 per cent. | |

Total cost.

86. The total of these amounts to 27·4 per cent. on works without considering the case of wells, in the construction of which exceptional difficulty is met with; it may fairly be assumed that an ordinary well to the mota, including all contingencies, can be sunk complete for Rs. 36·5 per 100 cubic feet of masonry.

This figure represents—

| | |
|---|---|
| Actual masonry, | Rs. 25 per 100 cubic feet. |
| Sinking, .. | 25 per cent. of cost of masonry. |
| Earthwork, .. | 5 „ „ „ |
| Curb, .. | 10 „ „ „ |
| Contingencies, .. | 6 „ „ „ |

Cost of fittings.

87. This does not include the cost of fittings, which it is presumed the cultivator will supply himself. In the Table of relative cost, these items are separately shown to allow of a comparison with the rates worked to by the people themselves.

Estimate low.

88. The prices fixed above have been kept down to the point at which it is only possible to do the work. They will require the most careful supervision to avoid excess, and allow nothing for unexpected difficulties.

89. TABLE I.—*Relative Cost of Wells if constructed by Government.*

| Masonry well on mota. | Depth to water surface. | CONSTRUCTION. Works. | Indirect. | Total. | Interest at 6 per cent. | RATE PER ACRE. Area irrigated in the year. | Charge per acre. | Fittings. | ANNUAL. Lifts. | Total. | Annual charge per acre for fittings and lifts. | Total charge per acre. | Remarks. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1-Lift, ... | 10 | 117 | 33 | 150 | 9·0 | 11·0 | 0·8 | 5/- | 8/- | 8·3 | 0·8 | 1·6 | |
| | 15 | 146 | 40 | 186 | 11·16 | 10·75 | 1·0 | ... | ... | 8·3 | 0·8 | 1·8 | *1-Lift wells*— |
| | 20 | 175 | 48 | 223 | 13·38 | 10·5 | 1·2 | ... | 9/- | 9·3 | 0·9 | 2·1 | 4 feet inside diameter. 1 foot thickness of cylinder. 10 feet below water surface. |
| | 25 | 204 | 56 | 260 | 15·6 | 10·25 | 1·5 | ... | ... | 9·3 | 0·9 | 2·4 | |
| | 30 | 234 | 64 | 298 | 17·88 | 10·0 | 1·8 | ... | 10/- | 10·3 | 1·0 | 2·8 | |
| | 40 | 292 | 80 | 372 | 22·32 | 9·0 | 2·5 | ... | 11/- | 11·3 | 1·2 | 3·7 | *2-Lift wells*— |
| | 50 | 351 | 96 | 447 | 26·82 | 8·5 | 3·2 | ... | ... | 11·3 | 1·4 | 4·6 | 6·5 feet inside diameter. 1 foot thickness of cylinder. 12 feet below water surface. |
| | 60 | 410 | 112 | 522 | 31·32 | 8·0 | 3·9 | ... | 12/- | 12·3 | 1·6 | 5·5 | |
| 2-Lift, ... | 10 | 189 | 52 | 241 | 14·46 | 22·0 | 0·6 | 9/- | 16/- | 16·6 | 0·8 | 1·4 | *3-Lift wells not economical.* |
| | 15 | 232 | 64 | 296 | 17·76 | 21·5 | 0·8 | ... | ... | 16·6 | 0·8 | 1·6 | |
| | 20 | 275 | 75 | 350 | 21·0 | 21·0 | 1·0 | ... | 18/- | 18·6 | 0·9 | 1·9 | *4-Lift wells*— |
| | 25 | 317 | 87 | 404 | 24·24 | 20·5 | 1·2 | ... | ... | 18·6 | 0·9 | 2·1 | 8·5 feet internal diameter. 1·5 feet thickness of cylinder 15 feet below water surface. |
| | 30 | 360 | 99 | 459 | 27·54 | 20·0 | 1·4 | ... | 20/- | 20·6 | 1·0 | 2·4 | |
| | 40 | 446 | 122 | 568 | 34·08 | 18·0 | 1·9 | ... | ... | 20·6 | 1·1 | 3·0 | |
| | 50 | 532 | 146 | 68 | 40·68 | 17·0 | 2·4 | ... | 22/- | 22·6 | 1·3 | 3·7 | |
| | 60 | 618 | 170 | 788 | 47·28 | 16·0 | 3·0 | ... | ... | 22·6 | 1·4 | 4·4 | |
| 4-Lift, ... | 10 | 429 | 117 | 546 | 32·76 | 44·0 | 0·7 | 15/- | 32/- | 33·0 | 0·8 | 1·5 | |
| | 15 | 514 | 140 | 654 | 38·24 | 43·0 | 0·9 | ... | ... | 33·0 | 0·8 | 1·7 | Lifts Kili, one unit each. The areas are deduced from Muttra and Aligarh maximum-areas which are the best substantiated. They are double the Lagor areas of Rai Bareilly, which has the highest percentage of irrigation in the Provinces, *see* Appendix IV. |
| | 20 | 600 | 164 | 764 | 45·84 | 42·0 | 1·1 | ... | 36/- | 37·0 | 0·9 | 2·0 | |
| | 25 | 686 | 188 | 874 | 52·44 | 41·0 | 1·3 | ... | ... | 37·0 | 0·9 | 2·2 | |
| | 30 | 772 | 212 | 984 | 59·04 | 40·0 | 1·5 | ... | 40/- | 41·0 | 1·0 | 2·5 | |
| | 40 | 943 | 260 | 1,203 | 72·18 | 36·0 | 2·0 | ... | ... | 41·0 | 1·2 | 3·2 | |
| | 50 | 1,113 | 307 | 1,420 | 85·2 | 34·0 | 2·5 | ... | 44/- | 45·0 | 1·3 | 3·8 | |
| | 60 | 1,284 | 350 | 1,634 | 98·04 | 32·0 | 3·0 | ... | ... | 45·0 | 1·4 | 4·4 | |

4-lift wells the best.

90. The uniformity of the results shown were somewhat unexpected, for there does not appear to be any great saving in one class over another, but as shown in the note on "various methods of lifting," there is a great saving in the cost of drawing water when 2 lifts are worked together at the same side of a well; the 4-lift wells are, therefore, the best as far as regards the cost of delivering water from a well. The diameters given in the table are the minimum used for the number of lifts, and are only just large enough for full sized *purs;* it would be an advantage to increase them slightly all round in practice.

Increased depth of water.

91. The depths below water surface, *i.e.*, 10 feet for 1-lift to 15 feet for 4-lift are relatively increased, as an increased head is required to supply a number of lifts in the same well.

Cost of fittings.

92. The cost of fittings has been thrown on the cultivators; it would be far better for Government to incur the increase of capital, and fix good stone uprights and platforms on each well. This cost would be repaid by the stimulus given to early irrigation, as often at first combinations are difficult, and no one Assami will care to go to the expense of fitting up a well, the benefits of which he will only partially enjoy.

Cost of lifts.

93. The cost of the rope and *churrus* will of course fall on the actual irrigator.

Interest charges.

94. Advances for productive Public Works are now made by the Government of India at 4 per cent.; the interest on Capital has, therefore, been charged at 6 per cent., to allow for unforeseen charges, preliminary operations, settlement, &c.

Dry brick wells.

95. Dry brick wells have not been estimated, as where they are built, kucha wells are nearly always possible, and the lining is used merely as a means of protecting them from the wash of the bucket, a matter which should be encouraged as much as possible, but which scarcely calls for direct Government interference, as the expense is usually small. Percolation dry brick wells cannot be recommended. When the supply is near the surface the Dhenkli and Ráti are a much cheaper means of lifting water than a *churrus* from a surface lowered to obtain the head which is required by the latter, and when the depth to subsoil surface is great, it will be found that the increase in cost of lifting due to a small and intermittent supply, will render them more a source of loss than profit to the Assami, and they fail utterly in very dry years unless carried to such a depth as to render their cost prohibitive.

The profit on expensive wells doubtful.

96. The cost of a masonry well depends directly on the depth of the true mota, this may be great even though the sub-soil water surface is high; in such cases and in instances when special means, such as pipes, &c., are used, the Revenue officer alone can tell whether the transaction will be a paying one or not, and that within wide limits, as the final result both as regards expenditure and success is always doubtful.

Bricks.

97. The best description of brick to use for wells depends on the mortar, if this is good, large voussoirs may be employed for the cylinders, but when the quality of the lime is doubtful, small country bricks are to be preferred, plenty of water should be used, and a long time given to the work to set.

*Percolation* into water-courses.

98. A matter intimately connected with the construction of wells is the loss due to percolation from water-courses. This seriously interferes with the success of large wells. From Abstract Table C it appears that the mean loss is about two cubic feet per foot run, during a day of 9 hours, and that the loss of area varies from 30 to 50 per cent. per well for a water-course 500 feet long. Some experiments recently made by Mr. Beresford on the Anupshahr Branch, Ganges Canal, showed out of a total supply of one cubic foot per second a loss of 0·5 cubic foot per second in a distance of 1·5 miles, the soil being sandy for one mile; this for a day of 9 hours = 2·0 cubic feet per foot run, and the results shown may, therefore, be assumed as fairly correct.

Can be prevented.

99. This loss can be entirely obviated if the channels are lined with an impermeable material, and if pipes or concrete are used the cost will amount to about Rs. 10 per 100 running feet.

Cost of masonry channels.

100. The maximum annual area irrigable by a 4-lift well at 30 feet to water surface is shown as 60 acres. The best disposition of this area will, I think, be a parallel strip with the well in the centre on elevated ground, and this is not an uncommon arrangement of area for large wells, and suits the natural lie of the country, as the channel will be on the watershed with the irrigable area gently sloping on both sides.

The width *ab* (*Fig.* 17, *Plate* II.) should depend on the nature of the soil, but if for the 4-lift well we assume it at 400 feet, we find the length of permanent water-course required will be $\frac{34 \times 43560}{400}$ feet — 800 feet = 3,000 feet, which at Rs. 10 per 100 = Rs. 300, and even assuming that it only saves one cubic foot per foot run, the amount spent will more than cover the cost of construction of a well capable of supplying 3,000 cubic feet per day, and entirely save the cost of re-lifting the actual water. It would, therefore, appear advantageous to add permanent channels to all wells built by Government. The cost will vary from 50 per cent. of direct construction in the case of low lifts, to 12 per cent. for a depth of 60 feet, or nearly 10 per cent. per foot of rise in water surface, and this will also tend to equalize the rate per acre to be charged.

A rate of Rs. 2 per acre necessary to cover cost of construction.

101. Taking all contingencies into consideration, a round rate of Rs. 2 per acre of annual irrigation appears to be the mean charge required to cover outlay.

## COST OF WELL IRRIGATION.

Cost variable.

102. There are few wells to be found in the Doáb from which irrigation is carried on under precisely similar circumstances. Climate affects the number and depth of the waterings given, and there are marked variations in the characteristics of the cultivators, cattle, wells and methods of lifting water.

Estimate possible.

103. The one advantage we possess in attempting an estimate of the cost is, that each individual well or cluster of wells is a fixture in its own plot of land, the boundary of which can be determined with reference to surrounding wells, and the maximum quantity of water which can be lifted in a day.

Division of cost.

104. Every crop that is watered from a well bears a cost over a dry crop, the total of which is made up from three main heads, *viz.*—

A. Interest on capital.
B. Annual charges.
C. Cost of lifting the quantity of water required.

Dry crops.

105. The word dry is intended to refer to crops raised in lands unprovided with wells, as even when owing to the necessary quantity of rain having fallen, well lands are not watered, they have still to bear the yearly interest charges.

### A.—*Interest on Capital.*

Interest.

106. The capital invested is the necessary cost of construction of the well with its fittings, and this varies from Rs. 2 to Rs. 1,000 with the class of well and advantages of the situation.

The cost and description of the different kinds of wells and fittings met with in the Doáb have been already given, and the detail of those examined will be found in Table A., columns 44 and 45. It was impossible to ascertain with accuracy the cost of very old wells, and even in the case of those recently built, it is difficult to fix the exact expenditure, both home materials and labor are used, the construction is often spread over a long period, and few Zemindars keep accounts, but a fair idea can usually be formed from a due consideration of the difficulties met with, the facilities for obtaining material, and the relative cost of similar wells, the expenditure on which is known. When no other means were available the sum was fixed at about one-half of what it would cost Government to build such a well.

In Table G. the interest at 5 per cent. of the cost of the experimental wells is distributed on the area actually irrigated during the year—both rabi and kharif. In many instances there was no kharif irrigation, in others it was difficult to ascertain correctly. When such was the case one-half of the rabi was added for kharif to make up the yearly irrigation, and the incidence of the rate is shown on this area.

Rabi irrigation.

107. The rabi area is made up of crops which require a different quantity of water at various intervals, the maximum rabi area which can be watered, therefore, depends on the quantity of water raised and the crops grown.

Periods of crop growth.

108. Table D. shows the periods of crop growth for the districts examined. It is compiled from the famine replies, and the mean number of waterings and intervals between waterings entered were collected from personal enquiry.

Intervals between waterings.

109. The intervals multiplied by the waterings do not always fit in exactly with the length of time the crop is shown in the ground, but this is only to be expected, as the waterings shown are those required in years when the cold weather rainfall is deficient, and the intervals the maximum the crop will remain uninjured without water.

Percentage of crops irrigated.

110. The wells experimented on were, as far as could be managed, the best in each village visited, and the line of country was chosen so as to bring every class under examination, and Table B. shows the actual area irrigated by crops per well, lift, and pair of cattle or man employed lifting water. The mean area and the percentages of crops for each district are shown, and also over each crop area the actual statement of the Assami regarding the number of waterings required is given.

Days required per watering.

111. Table F. shows the number of days required per pair of cattle or man actually lifting water to irrigate an acre at three different depths of watering, and by division, or addition, of these depths, the number of days required for any given depth can be readily obtained.

Depth of waterings.

112. The mean depth of watering given in each district per crop is shown in Table B., and the same reduced by the loss from absorption in water-courses in Abstract Table C.

Information in Tables.

113. We have, therefore, for each well, village and district a close approximation to, if not actual

Depth of watering in feet,
Number of waterings required,
Working days to the acre,
Intervals between waterings,
Percentage of crops grown and periods of growth,

and it is then a simple calculation to determine the maximum area which can be irrigated of any fixed proportion of crops, or of the percentage suitable to the district in which the well is situated.

The cost by Districts and lifts.

114. Table H. shows a final result for districts. The figures for those in which there were a large number of experiments are naturally most to be depended on, and fortunately this occurs in the best irrigating districts.

The rabi irrigating season.

115. A reference to the abstract of Table D. will show that, rejecting carrots, potatoes and tobacco, and making due allowance for ripening, the average time available for watering the rabi may be fixed at 180 days; but except in the case of wells on which a large number of cultivators per lift work jointly, this period must be considerably reduced. The same cattle cannot be worked more than 20 days in the month at such severe labor without serious injury; indeed this is the period generally given by cultivators themselves as a maximum, nor will any except the best wells stand such a constant strain. It will be safe however, to assume 150 working days as available, as few wells have less than two cultivators working at them. When potatoes, tobacco and carrots are grown this period is often exceeded, but wells which take 150 days to water their rabi crop area may be considered as fully worked, and from Table G. we find that the mean interest rate on cost of construction per acre on $\frac{3}{4}$ of the maximum rabi area is Rs. 4 for Muttra, when the depth to water surface is great, *viz.*, 60 feet, and the wells are nearly all masonry, and Rs. 1-8-0 for the other districts, with a mean depth to water surface of 30 feet and all classes of wells.

Assumed maximum not reached in practice.

116. Only one-fifth of the wells examined attained their assumed maximum rabi area; the figure cannot, therefore, have been fixed too low; many had no kharif irrigation, and in only two did it exceed the allowance made of half the rabi area, the actual rate per acre in 1881-83 must, therefore, in the majority of cases have been far above the figures given.

Wells with no rabi irrigation.

117. Some wells have no rabi area. Kucha wells are dug in both Bundelkhand and Rohilkhand solely for sugarcane irrigation, which is often watered when other crops are grown dry.

Number of wells or units required for a given area.

118. A considerable difference of opinion exists as to the total area which should be allotted to each well, or rather to each unit (*see* para. 4). We find in Table II. the mean yearly command for each district per unit, but even in the most closely cultivated tracts of the Doáb there is fallow, or land not cultivated in either the kharif or rabi of the same year, so that, even were the whole cultivated area yearly irrigated, which it is not, we could not get the number of units required by dividing the total area by the unit area. It will be seen also (*vide* Table C.) that there is a serious loss of water when taken a long

distance, and cultivators are fully aware of this;* yet the disconnection of the tracts of mota and the mixture of good and bad land in many places necessitates either the isolation of the irrigation, or the carriage of the water for a long distance, in which case the available unit area would perhaps not be worked up to.

Sample cases.

119. With reference to the proportion of cultivated land which is yearly irrigated, I had hoped, but have not had time, to give some examples showing the allotment of irrigated and dry crops in certain type villages over a series of years, it would be found to be curiously permanent. Occasionally Assamis hold land in two parts of the village, usually termed the "har" and "chahi;" in the *har* they cultivate rain and dry crops,† and round their wells those which they wish to water, and in highly irrigated villages this land is frequently double cropped, (a reference to Table A., column 11, will show that the double cropped area increases in a marked degree with the percentage of well irrigation,) adding another to the many difficulties of the estimation.

Actual figures available.

120. Statistics showing the actual area commanded by each unit of irrigation might be obtained by recording the fields irrigated from certain selected wells over a term of years, but the variations are so great in individual wells, that this would be necessary for a large number of cases to obtain an average figure. Perhaps the best approximation is to be found by dividing the number of units in highly irrigated villages into the cultivated area. It is necessary to select villages which irrigate from no other source than wells, and from the villages examined presenting the maximum percentages, it is evident that there is a considerable difference in the proportion which the total area ever irrigated bears to the area actually irrigated in any one year by each unit, as it varies from 7 to 150 per cent. of the year's irrigation, even when the percentage of the total area of the village irrigated is large. It is influenced mainly by the nature of the soil with reference to its powers of being double cropped, and the class of cultivator, and although for a general estimate we may assume the proportion of *cultivated* area to be allotted to each unit at double its power of yearly irrigation, yet it is evident that the exact allowance to be made should be carefully worked out from existing examples for every tract taken specially in hand.

Difficult of estimation.

121. The above remarks will, it is hoped, convey an idea of the difficulty of correctly estimating the gross cultivated area which should be allotted to each well under the mixed agricultural conditions which exist in the Doáb.

Rate must be struck on yearly irrigation.

122. This apportionment of area is only important so far as it effects the mean rate to be borne by the gross area commanded, and the correct distribution of wells. It must be remembered that the interest charge is yearly, and that therefore the area yearly watered has really to pay the whole interest, and this simplifies the calculation considerably. For the double cropped a most embarrasing item of the gross area need not be considered, the maximum yearly command being independent of it, and the construction rate in consequence is calculated on this area, and I think it will be admitted correctly so.

123. Few except those who have enquired into the history of large heavily worked wells can be aware of the complicated nature of the cultivator's agreements and arrangements regarding them.

Rath wells.

There are two sets of four wells each in Rath Hamirpur, from which no less than 61 *Kachis* irrigate, every man having his particular number of hours or days of work laid down, which were fixed with reference to the share of cost of construction he or his forefathers paid, and so accurately have they estimated the area they can water, that the crops are uniformly good, although they consist of tobacco and opium, both of which suffer seriously from any delay in watering, and these are heavily worked wells with a maximum unit area—*see* Appendix VIII.

Sitapur well.

124. Again in Sitapur, Aligarh, *vide* Appendix VII., there are two 8-lift wells working 28 and 32 head of cattle per well respectively. On these all the cultivators work jointly together, and actually count the number of lifts made, so that each day's work may be alike. Now every Assami on these wells has a different area at varying distances, and

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*In detailing the time required to water distant fields they often state double the period required for those near the well, and give the distance as a reason.

† The same crops are often cultivated in one village both wet and dry. Part wet to make a certainty of some return from the cattle available, and part dry in hope of rain.

with crops requiring different depths, waterings and intervals. How complicated their accounts must be can be imagined, and many other instances could be quoted.

**Cost of kucha wells.**

125. The relative cost of deep masonry or dry brick wells compared with shallow ones is great; it is not so in the case of those which are kucha. The almost universal rate for excavation down to the mota when wet sand is not met with is Rs. 1-4-0, whether the depth be 20 or 60 feet; the earth taken out is used for the ramp, and the explanation of the fixed rate is simple, as even a 60 feet well will not give sufficient earth for a ramp. A special class of workmen are paid 4 annas a day, each to cut the hole in the mota and prepare the bottom of the well for the bucket. This costs from Rs. 1 to 3, so that even a 60 feet kucha well can be built for Rs. 5 if no difficulties are met with, and it may last 100 years or more with no repairs but a yearly cleaning out.

When wet sand or any stratum which will not stand without support is met with above the mota, a lining has to be added, which costs an indefinite sum, varying from 8 annas to Rs. 10, and has usually to be renewed yearly. In these cases the well is short lived, and in Table A. interest is charged on the cost of construction, divided by the average number of years wells last in that particular tract.

**Cost of kucha wells dependent on sub-soil.**

126. It may be seen, therefore, that the cost of *kucha wells* is influenced *directly by the nature of the soil. Masonry wells* are practically independent of the nature of the sub-soil so long as a mota exists; they are sunk rather easier through wet sand than clay, and when well built require no other repairs than a yearly cleaning out, their cost therefore depends *directly on their depth.*

**Wood lined wells.**

127. Wells lined with wood or other semi-permanent material are considered as kucha, and their cost calculated accordingly.

The people constantly build kucha occasionally dry brick and wood lined, and very seldom masonry wells, directly for irrigation, the reason is obvious, as no crop could bear the direct charge due to a very deep masonry well, but happily the results of their religious feelings here tend to the prosperity of the country.

B.—*The Annual Charges.*

**Annual charges.**

128. These have been referred to before, and consist in—

(1). Renewals or that proportion of the first cost of the well which it is necessary to charge yearly to provide for its necessary re-construction.
(2). The cost of the lift.
(3). Repairs.

These require no further explanation. They vary with nearly every class of well, and fair average rates for the interest and annual charges combined will be found in Table A. for each district.

C.—*The cost of lifting the quantity of water required.*

**Cost of lifting water.**

129. This is a simple matter to determine, compared with the interest charge, for an average number of hour's work in the day (which has been assumed at 9 for the calculated Tables), a co-efficient can be fixed for any well with its cultivators and cattle.

The mean cost of lifting 100 cubic feet of water from wells in the Doáb is 0·454 of an anna,* and this has been determined by measuring the quantity lifted during the whole day from more than 150 wells distributed over a large area. It varies naturally a good deal with different class of cultivators, bullocks and wells. The full details of experiments will be found in the Tabular Statements, and it is certainly remarkable to note how similar the results are, within certain boundaries which are roughly defined by the various districts, and this shows the great errors that may be made by predicating any general principles from purely local enquiries.

**Work done.**

130. The work done by any number of bullocks or men at a well is made up of frictional resistance overcome, water, and dead weight lifted, the results of the day's work is

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* Cattle Lagor = 0·514 — Men Dhenkli = 0·183.
Men „ = 0·624 — „ Rati = 0·165.
Cattle Kili = 0·330

given for each well in Table E., friction having been neglected, for it is difficult or impossible to estimate accurately, and the resistance due to it is so much effected by the quantity of lubricating material applied to the pulley, that its admission into the calculations might prove a source of serious error.

From the work column in Table F. it will be seen that the percentage of—

Useful work.

131. *Useful work—decreases* directly with the depth to water surface with cattle; *increases* directly with the capacity of the lift.

Is a maximum with Dhenklies and Rátis, in which there is no loss but friction, and is not much effected by the depth in the case of coolie lifts, as men turn quickly.

Total work.

132. *The total work done per head**—Is a maximum with cattle working Kili, *vide* No. 492, where 3·064 foot tons per minute were lifted.

It is a minimum with hired men working a Dhenkli, *vide* No. 501.

Decreases as the number of cattle on each lift are increased, (but cost also decreases.)

Is practically identical for men working Lagor, the actual figures for the five wells experimented are—

| No. of men. | | Depth to water surface. | | Foot tons per head per minute. |
|---|---|---|---|---|
| 6 | ... | 31 | ... | 0·487 |
| 6 | ... | 35 | ... | 0·488 |
| 6 | ... | 30 | ... | 0·472 |
| 8 | ... | 17 | ... | 0·440 |
| 7 | ... | 38 | ... | 0·477 |

Some of these men were hired, some home labor; the agreement in result is curious, and one ton lifted 6 inches high in one minute may be taken as the maximum work a man can do at such labor.

The foot ton the co-efficient.

133. The foot ton per minute is the co-efficient of the well, and is a more convenient figure than the actual horse-power which, however, can be approximated by dividing it by 15 The mean weights of the various sizes of lift used, Lagor and Kili, are as follow:—

Up to 2 cubic feet, 14 lbs.
2 „ 3 „ „ 16 „
3 „ 4 „ „ 20 „
4 „ 5 „ „ 24 „
5 „ 6 „ „ 28 „
6 „ 7 „ „ 32 „

This is including the ring, which increases the proportional weight of the larger lifts, as it is then usually made of iron. The following formula was used in working out the work done:—

$$\text{Height of lift} \times \left\{ \frac{\text{Cubic feet lifted} \times 62{\cdot}33 + \text{No. of lifts} \left( \text{weight of lift} + \frac{\text{weight rope}}{2} \right)}{\text{No. of cattle or men} \times \text{No. of minutes} \times 2240} \right\}$$

The height of lift taken is the maximum, as it is from that depth the water is drawn over the greater part of a day's work. The result of the formula is not strictly accurate, but very nearly so.

Depth of watering.

134. The depth of water given to the various crops is shown in Table E.; it was obtained by dividing the number of cubic feet lifted during the day into the area irrigated during the same period, and as far as its useful effect is concerned should be reduced by the loss from percolation consequent on the length of the water-course.

Considering the extended area over which the observations were made, and the variation in climate and soil, the depths agree so far as to show a marvellous knowledge of his business in the Assami, who it could be wished would display a similar care when dealing with canal water.

How varied by soil.

135. With regard to soil, it is probable that the rate of evaporation is the principal factor that determines the quantity of water given. As the depth of damp is greater in

* Cattle or men.

sand than in *matyar* or *dumat*, so presumably the evaporation is slower. I failed, however, to gather any substantial facts showing that any difference is made in the quantity given to the different soils by the Assami. The amount is so much more varied by the disturbing influences of cost, depth of well, distance of field, quality of cattle, climate, &c., &c., that a rule will with great difficulty be discovered, and cattle or men be of but local application.

The depth and number of waterings given in the Tables are those for a rabi season of deficient rainfall after a good kharif, and 1881-82 was an eminently favorable year for observation.

Mean depths.

136. The following may be taken as a fair average of the depths given in feet :—

| Crop. | First watering. | After waterings. |
|---|---|---|
| Wheat, ... ... ... | ·2500 | ·1860 |
| Barley, ... ... ... | ·1860 | ·1860 |
| Tobacco, ... ... ... | ·1860 | ·1250 |
| Opium, ... ... ... | ·1860 | ·1250 |
| Carrots, ... ... ... | ·1860 | ·1250 |
| Potatoes, ... ... ... | ·1860 | ·1250 |
| „ in ridges, ... ... ... | ·1250 | ·0930 |
| Gardens, ... ... ... | ·0930 | ·0930 |
| Sugar, ... ... ... | ·2500 | ·2500 |

Subsidiary crops.

137. Subsidiary crops are usually given the watering required by the major crop.

Depth of damp in soil.

138. The depth of damp occasioned by a watering appears to be more affected by the depth of ploughing than by the percolation power of the soil, except in very sandy tracts.

Deep ploughing.

139. The advantages of deep ploughing as a water retaining measure is here patent, and this perhaps tends to explain why sandy soils have fewer waterings than those of a more clayey nature.

Labor rates.

140. The labor rates charged have been already remarked on, they are as follows :—

*Bullocks*, ... 3 annns per pair, { to cover share of purchase. „ „ renewals. „ „ food while working.

*Coolie labor hired*, actual rates paid varying from 2 annas to 6 pies.

*Labor home*, ... one anna per day, deducting one man from the total number employed during the day.

*Bullocks.*—This rate can scarcely be reduced ; it, however, seriously influences the relative cost in districts working bad cattle. The charge for good bullocks should really be raised, but it would have caused much complication in the calculations.

*Home labor.*—A man can live on less than one anna a day, but the work is very heavy, particularly coolies working Lagor.

Net rates per crop.

141. The actual and mean rates are worked out in Tables G. and H., and the following rates may be taken as representing the net outlay incurred over the Doáb.

| Crop. | Rs. | As. | Crop. | Rs. | As. |
|---|---|---|---|---|---|
| Wheat, ... ... ... | 8 | 0 | Carrots, ... ... ... | 10 | 0 |
| Wheat and barley, ... | 7 | 5 | Peas, ... ... ... | 2 | 5 |
| Wheat and gram, ... | 7 | 0 | Oats, ... ... ... | 10 | 0 |
| Barley, ... ... ... | 6 | 0 | Opium, ... ... ... | 15 | 0 |
| Barley and gram, ... ... | 5 | 0 | Tobacco, ... ... ... | 15 | 0 |
| Barley and peas, ... ... | 5 | 0 | Potatoes, ... ... ... | 12 | 5 |
| Safflower, ... ... | 4 | 0 | Garden, ... ... ... | 12 | 0 |
| Safflower and carrots, ... | 6 | 0 | Sugar-cane, ... ... | 12 | 0 |
| Gram, ... ... ... | 2 | 5 | | | |

The above rates only cover cost of food for labor.

Calculations for Dhenkli and Rátis imperfect.

142. From the calculated rates it appears that the Rátí is the most economical, and coolie Lagor the dearest method of raising water, but it is necessary to note that in a single

Rátí or Dhenkli two persons are employed, and that owing to the principle of excluding one person on each well from the calculations of cost, only one person per day is charged, and at one anna, as Dhenkli and Rátis are almost universally worked by home labor. If however the cost of lifting by these methods is even doubled, it will still be cheaper than any other system for the same depth, but it is very slow, and when the number of lifts is increased the area of land taken up is considerable, and if culturable its value must be added. The loss from percolation, also due to several small water-courses, would be greater than in the case of a *churrus* well.

Rate lower than those calculated by Major Erskine.

143. These rates are considerably below that arrived at by Major Erskine, the Secretary to Government, Oudh Revenue Department, in office memo. No. 2252, dated 16th August, 1881 ; and the difference is due to the assumption of lower labor rates, the now known reduction in quantity of water used for secondary irrigation, and also the marked variation in quantity which different crops are given.

Comparison with canal rates.

144. That these rates represent outlay similar to the actual cash paid for canal water there can be little doubt, and the comparison of rates is instructive, *vide* Appendix XII.

145. *The total charge for well irrigation per acre.*—The actual total charge for each crop cultivated during the rabi on every well experimented on is shown in Table G., and in the Abstract the mean rates for each district; these rates are at their lowest point, when 150 or more days are required to irrigate the rabi area, and therefore in consulting the record for fair rates such examples should be examined.

There is no difficulty in working out from the tables the maximum rabi area for any well for which the crops to be grown and the quantity of water which can be lifted each day are known.

It will be seen from Table B. that, excluding the northern districts, a larger variety and higher class of crops are irrigated in good Kili than in Lagor tracts, and the extent of rabi area will be modified accordingly.

Rule for calculating mean rate of watering.

146. Taking the percentages of crops given in Table B. and the mean work from Table F., the mean rates for each class and lift can be obtained by multiplying the percentages of crops by the number of days required to water an acre of each, and dividing the total by 100, we thus get the number of days required to water an acre of the average crop, and this figure divided into 150 days will give the rabi command. By adding 50 per cent. we have the maximum area which can be yearly irrigated in the kharif and rabi, and the following Table gives the figures for the different districts and classes, and also the cost at cultivator's rates for a suitable well, when the mota can easily be reached. It is evident that highly irrigated crops should pay a larger share of the total rate, but for general purposes it may be equally divided.

TABLE K.—*Maximum area which can be yearly irrigated and Interest Rate.*

| District. | Class. | Labor. | Depth to water surface. | Maximum area per unit. | | | No. of units per well. | Area per well. | Capital Cost. | | | Annual. | | | | Remarks. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Rabi. | Kharif. | Total. | | | Well. | Fittings. | Total. | Interest at 5 per cent. | Lifts. | Total. | Rate per acre. | |
| Cawnpore, ... | Lagor | Cattle | 47 | 5·0 | 2·5 | 7·5 | 2 | 15 | 285 | 5/- | 290 | 14·5 | 14/- | 28·5 | 1·9 | All crops. |
| Hamirpur, ... | ,, | ,, | 40 | 4·2 | 2·1 | 6·3 | 2 | 12·6 | 250 | 6/- | 256 | 12·8 | 13/- | 25·8 | 2·0 | ,, |
| Farukhabad, ... | ,, | ,, | 47·5 | 6·0 | 3·0 | 9·0 | 1 | 9·0 | 220 | 3/- | 223 | 11·2 | 8/- | 19·2 | 2·1 | ,, |
| Mainpuri, ... | ,, | ,, | 20 | 7·5 | 3·75 | 11·25 | 2 | 22·5 | 150 | 6/- | 156 | 7·8 | 17/- | 24·8 | 1·1 | ,, |
| Etah, ... ... | ,, | ,, | 17·8 | 5·3 | 2·65 | 7·95 | 2 | 15·9 | 140 | 6/- | 146 | 7·3 | 16/- | 23·3 | 1·5 | ,, |
| Shahjahanpur, | ,, | ,, | 34·5 | 7·1 | 3·55 | 10·65 | 1 | 10·65 | 170 | 3/- | 173 | 8·7 | 9/- | 17·7 | 1·7 | ,, |
| Lucknow, ... | ,, | ,, | 31 | 3·3 | 1·65 | 4·95 | 2 | 9·9 | 200 | 5/- | 205 | 10·3 | 7/- | 17·3 | 1·7 | ,, |
| Hardui, ... | ,, | ,, | 30 | 3·4 | 1·6 | 5·0 | 3 | 15·0 | 220 | 6/- | 226 | 11·3 | 7/- | 18·3 | 1·2 | ,, |
| Saharanpur, ... | ,, | ,, | 23 | 3·6 | 1·8 | 5·40 | 1 | 5·4 | 130 | 3/- | 133 | 6·7 | 6/- | 12·7 | 2·3 | Garden. |
| Shahjahanpur, | ,, | Men | 31 | 3·2 | 1·6 | 4·8 | 3 | 14·4 | 150 | 3/- | 153 | 7·7 | 5/- | 12·7 | 0·9 | All crops. |
| Lucknow, ... | ,, | ,, | 27·3 | 3·7 | 1·8 | 5·5 | 3 | 16·5 | 140 | 3/- | 143 | 7·2 | 5/- | 12·2 | 0·7 | ,, |
| Hardui, ... | ,, | ,, | 38 | 3·2 | 1·6 | 4·8 | 3 | 14·4 | 200 | 3/- | 203 | 10·2 | 5/- | 15·2 | 1·0 | ,, |
| Aligarh, ... | Kili | Cattle | 28 | 7·0 | 3·5 | 10·5 | 3 | 31·5 | 240 | 7/- | 247 | 12·4 | 20/- | 22·4 | 0·7 | ,, |
| Muttra, ... | ,, | ,, | 61 | 5·5 | 2·75 | 8·25 | 2 | 16·5 | 360 | 6/- | 366 | 18·3 | 15/- | 33·3 | 2·0 | ,, |
| Etah, ... ... | ,, | ,, | 22 | 8·3 | 4·15 | 12·45 | 2 | 24·9 | 160 | 6/- | 166 | 8·3 | 18/- | 26·3 | 1·0 | Only two examples. |
| Bulandshahr,... | ,, | ,, | 24 | 6·1 | 3·1 | 9·2 | 3 | 27·6 | 220 | 7/- | 227 | 11·4 | 20/- | 31·4 | 1·1 | All crops. |
| Meerut, ... | ,, | ,, | 26 | 7·0 | 3·5 | 10·5 | 3 | 31·5 | 230 | 7/- | 237 | 11·9 | 20/- | 31·9 | 1·0 | ,, |
| Muzaffarnagar, | ,, | ,, | 18·8 | 5·0 | 2·5 | 7·5 | 4 | 30·0 | 230 | 3/- | 233 | 11·7 | 10/- | 21·7 | 0·7 | Only one example. |
| Bijnor, ... | ,, | ,, | 16 | 3·7 | 1·85 | 5·55 | 4 | 22·2 | 200 | 3/- | 203 | 10·2 | 9/- | 19·2 | 0·9 | Calculated at wheat 50 per cent. one watering, and garden 50 per cent. |
| Moradabad, ... | ,, | ,, | 19 | 6·5 | 3·25 | 9·75 | 2 | 19·5 | 140 | 5/- | 145 | 7·3 | 9/- | 16·3 | 0·9 | All crops. |
| Bareilly, ... | ,, | ,, | 38 | 3·7 | 1·85 | 5·55 | 1 | 5·55 | 180 | 3/- | 183 | 9·2 | 8/- | 17·2 | 3·0 | ,, |
| Shahjahanpur, | Dhenkli or Ráti. | Men. | 20 | 1·0 | 0·5 | 1·5 | 1 | 1·5 | 3·0 | 1/- | 4·0 | 0·2 | 1/- | 1·2 | 0·8 | Garden kuchs wells. |
| Farukhabad, ... | | | 16 | 1·4 | 0·7 | 2·1 | 1 | 2·1 | 6·0 | 1/- | 7·0 | 0·4 | 1/- | 1·4 | 0·7 | ,, |
| Bijnor, ... | | | 21 | 0·9 | 0·45 | 1·35 | 1 | 1·35 | 3·0 | 1/- | 4·0 | 0·2 | 1/- | 1·2 | 0·9 | ,, |
| Moradabad, ... | | | 13·3 | 1·8 | 0·9 | 2·7 | 1 | 2·7 | 2·0 | 1/- | 3·0 | 0·2 | 1/- | 1·2 | 0·5 | ,, |
| Bareilly, ... | | | 9 | 2·0 | 1·0 | 3·0 | 1 | 3·0 | 2·0 | 1/- | 3·0 | 0·2 | 1/- | 1·2 | 0·4 | ,, |
| Hardui, ... | | | 10 | 4·0 | 2·0 | 6·0 | 1 | 6·0 | 4·0 | 1/- | 5·0 | 0·3 | 1/- | 1·3 | 0·2 | ,, |

The figures in column "maximum area per unit rabi" should be contrasted with the mean results at end of Table B—which show actuals.

Table K. shows also the incidence of the annual charges per acre, but it is evident that these figures are the very lowest that can possibly be worked to under the most favorable conditions.

Cost of irrigation for standard crops.

147. For purposes of comparison the total cost of irrigating one acre each of wheat, opium, and sugar are given below.

TABLE L.

| District. | WHEAT. | | | | | OPIUM. | | | | | SUGAR. | | | | | Remarks. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Kili. | Lagor. | Men. | Dhenkli. | Ráti. | Kili. | Lagor. | Men. | Dhenkli. | Ráti. | Kili. | Lagor. | Men. | Dhenkli. | Ráti. | |
| Cawnpore, ... | ... | 11·9 | ... | ... | ... | ... | 14·9 | ... | ... | ... | ... | ... | ... | ... | ... | The rates vary according to the number of waterings given and the quantity of water lifted per unit. |
| Hamirpur, ... | ... | 10·2 | ... | ... | ... | ... | 14·7 | ... | ... | ... | ... | 16·0 | ... | ... | ... | |
| Farukhabad, | ... | 12·6 | ... | 4·6 | ... | ... | 16·4 | ... | 5·8 | ... | ... | ... | ... | ... | ... | |
| Mainpuri, ... | ... | 8·1 | ... | ... | ... | ... | 15·8 | ... | ... | ... | ... | 12·3 | ... | ... | ... | |
| Etah, ... | 7·5 | 12·8 | ... | ... | ... | 11·5 | 19·4 | ... | ... | ... | 9·0 | 15·5 | ... | ... | ... | |
| Aligarh, ... | 7·6 | ... | ... | ... | ... | 15·7 | ... | ... | ... | ... | ... | ... | ... | ... | ... | |
| Muttra, ... | 10·7 | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | |
| Bulandshahr, | 9·0 | ... | ... | ... | ... | ... | ... | ... | ... | ... | 11·1 | ... | ... | ... | ... | |
| Meerut, ... | 8·0 | ... | ... | ... | ... | ... | ... | ... | ... | ... | 14·4 | ... | ... | ... | .. | |
| Muzaffarnagar, ... | 8·1 | ... | ... | ... | ... | .. | ... | ... | ... | ... | 12·2 | ... | ... | ... | ... | |
| Saharanpur, | ... | ... | ... | ... | ... | 15·3 | ... | ... | ... | ... | ... | ... | ... | ... | ... | |
| Bijnor, ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | 9·7 | ... | ... | 6·9 | ... | |
| Moradabad, | 3·5 | ... | .. | 1·5 | ... | ... | ... | ... | ... | ... | 9·3 | ... | ... | 4·5 | ... | |
| Bareilly, ... | 6·0 | ... | ... | ... | 2·1 | .. | ... | ... | ... | ... | ... | ... | ... | ... | ... | |
| Shahjahanpur, | ... | 3·7 | 4·0 | 2·0 | 1·9 | ... | ... | ... | ... | ... | ... | 5·7 | 7·1 | 4·0 | 2·8 | |
| Lucknow, ... | ... | 17·1 | 7·7 | ... | ... | ... | 21·8 | 9·7 | .. | ... | ... | 27·0 | 10·8 | ... | ... | |
| Hardui, ... | ... | ... | 8·0 | 2·3 | 2·7 | ... | ... | 11·1 | 3·5 | 4·1 | ... | ... | 26·0 | 7·7 | 9·3 | |

Value of produce.

148. Great difficulty has always been found in estimating the gross produce of an acre of any crop, and even when found, it is sometimes impossible to fix the value accurately. The subsidiary crops often give more profit than is generally thought, and indeed it is hard to understand how the Assami in some districts continues to farm unless the gross outturn is much greater than existing statistics lead us to suppose.

Opium.

149. The Opium Department Administration Report of 1880-81 gives the average produce per beegah for 1880-81 at 4 seers 3½ chittacks, this equals 6·75 seers per acre, and at the value given, *i.e.*, Rs. 5 per seer, equals Rs. 33-12-0 per acre, and the minor profits will probably bring this up to Rs. 35. Deducting the greatest charge for watering this, leaves Rs. 20 to cover rent and cultivation.

Wheat.

150. Mr. W. Crooke, C.S., the Manager of the Court of Ward's Estate, gives the following as the outturn of wheat in 1880-81 from an actual experiment.

| Wheat. | Total area sown. | Total yield. m. s. ch. | Produce per acre. m. s. ch. | Remarks. |
|---|---|---|---|---|
| Canal grain, .. | 7·64 | 120 19 0 | 15 31 0 | Well outturn best, but crop Muzaffarnagar white wheat showed a stronger tendency to revert to the local type with well than with canal water. |
| ,, bhusa, .. | .. | 178 10 0 | 23 16 0 | |
| Wells grain, .. | 6·25 | 111 32 8 | 17 38 0 | |
| ,, bhusa, .. | 1 | 164 0 0 | 26 13 0 | |

The value of this produce is probably not under Rs. 26, which leaves a margin of nearly Rs. 20 as in the case of opium.

**Sugar.**

151. The value of the sugar crop varies greatly according to the class of cultivation. In Lucknow and Hardui the crops examined were fine eating cane, which explains the high cost of irrigation, and at the average rate from even moderate crops, there will remain a large margin to cover cultivation and profit, *vide* Shahjahanpur Settlement Report, sec. 11, para. 37.

A rate of Rs. 2 necessary to cover interest on construction.

152. From the calculations which have been made of the cost of irrigation from wells, the result arrived at has been that a rate of Rs. 2 must be charged on the maximum area irrigable in the year, to cover the expenditure on construction under the most favorable conditions, and that the cost of the food consumed by the labor employed to fully water any crop will amount to about 30 per cent. of its gross value.

The calculated area a maximum.

153. The maximum area as calculated is certainly 100 per cent. over the average arrived at in practice; this is evident from the areas shown in column 35,* Table A, and from the figures kindly collected for me by Mr. A. Harrington, C.S., *vide* Appendix IV., where the average of 3,716 lifts gives 3 acres as the mean area irrigated in the rabi, and 5 acres as the maximum area irrigable in the year. The actual area irrigated in the year being only 3·21 acres, and this in Rai Bareilly, where the mota is plentiful and taccavi advances have been freely taken. It is evident that there is no room for expansion in these figures. Well, unlike canal irrigation, is not elastic. In famine years the possible area from wells is reduced by the weakness of the cattle and men, the increased depth and number of waterings required, and the diminution of the supply, while canals being snow-fed, the supply is increased by drought, and the area by the greater care taken with distribution, we have nothing therefore to hope for from an increase in area, and it is clear that purely hired labor cannot be extensively employed, for not only would the cost of irrigation be enormously increased, but the daily work done would be reduced.

Percolation wells costly to irrigate from.

154. Percolation or wells with a bad supply are not only in general more costly to construct, but much more expensive to irrigate from than mota wells. All the calculations of work have been made on the assumption of a good supply being available, the qualifying factor being the power of the men and cattle. If, however, they have to stop constantly to allow the supply to accumulate in the well, the amount of work they can do in the day will be lessened.

Well construction by Government cannot, I think, be successful in tracts in which there are either too great or too few facilities for irrigation, and unfortunately the districts first selected for experiment suffer doubly on these accounts.

Cawnpore wells.

155. In Ghatampur, Cawnpore District, the depth to water surface is 60 feet, this limits irrigation to the most favorable soils and crops, and increases greatly the charge per acre due to construction, and close to the wells which have been built, costing about Rs. 250 each; good kucha wells, costing Rs. 15, and giving an equal supply, are not impossible.

Moradabad wells.

156. In Moradabad exactly opposite conditions prevail—water is 10 feet from the surface, and the mota, though not unknown, is very scarce, owing to the climate; however irrigation, though desirable in ordinary years, is only absolutely necessary for a few crops, and a limited number of waterings is given. It has been shown that the cost of irrigation by Dhenkli and Rátis from a depth of 10 feet is much cheaper than by cattle from a depth of 20 or 30 feet, and it appears quite certain that the wells now being built, except when on the mota, will not give a sufficient supply for *churrus* working until the water surface has been reduced to 25 feet to give the necessary head. The yearly command of area in Moradabad may certainly be fairly fixed at a higher figure than in Cawnpore, as a less number of waterings is necessary, but the cost of the wells is also greater, and the charge for an annual Dhenkli well is insignificant. Both classes will suffer in drought, the masonry well probably the most, as it will give no supply at all if the sub-soil surface falls considerably, while Dhenklis and Rátis can be worked up to 25 feet. We must, therefore, look with diffidence for favorable financial results from these experiments.

Interesting as a scientific experiment.

157. The Moradabad wells are most interesting in an Engineering sense, for except

* Column 35 shows the area in acres per lift, and in many instances two or three units or pairs of cattle are used per lift; this is noted in the column of Remarks.

in the few instances when a clay or kunkur layer has been met with, the cylinders rest on pure sand, from which, as before noted, it is impossible to directly draw water without injury to the well. Wood and iron pipes from 5 inches to 3 inches diameter have been sunk to depths varying from 10 to 80 feet below the bottom of the wells, but except in one or two instances without meeting with any mota.

Three main experiments have been made—

1*st.*—With the pipe head resting in sand, the well having no bottom. Depth of water = 20 feet.

2*nd.*—With the pipe head resting in ballast, forming a permeable bottom to th well, which admitted of supply both from the area of the bottom of the well and from the pipe. Depth of water = 16 feet.

3*rd.*—With the pipe head embedded in concrete, forming an impermeable bottom to the well, all the supply had to come through a pipe 5 inches internal diameter. Depth of water = 16 feet.

The first experiment was made on a number of wells, and resulted in a rapid exhaustion of the water, the sand rising several feet into the wells causing the cylinders to sink.

The second experiment gave similar results.

The third experiment was carried out on the Chak Dhunowrie a 2-lift well. On the first two days water sufficient for one lift was obtained without injury to the well, but not until the surface had been reduced about 12 feet. On the third and following days, when work was stopped and the water was allowed to rise in the well, a sand discharge took place from the pipe, which had remained clear during the day.* Full reports on this experiment have not yet been received, and it may be possible to form a pocket of ballast at the bottom of the pipe which would stop the sand draw, but a largely increased supply cannot be anticipated.

Appendix IX. gives the progress of the wells under direct construction by Government up to the 11th May, 1882.

The experiments might judiciously have been confined to one or two wells until the possibility of construction in such a position had been demonstrated.

Extensive projects not advisable.

158. Great care must, therefore, be exercised in the selection of suitable sites, and all natural advantages secured, and this I fear will seriously prejudice the chances of the success of any large project. Well irrigation has been practised for such a long period, that the people have already extended irrigation to very near the natural limits of "available labor," "necessity for water," and "the power of obtaining it cheaply." A careful study of the statistics in Table A. will show that the percentage of the cultivated area irrigated in tracts of equal demand, very fairly corresponds with the opportunities of obtaining the supply, and I fear all that we can do with a prospect of financial success is to fill up the gaps that remain, and above all attend to the repairs of existing, though injured, wells, which very often only need the necessary tools, advice and a small advance.

The best irrigation in Canal districts.

159. Excepting Muttra, where there are strong indications of exhaustion of the sub-soil supply, the best well irrigation occurs curiously enough in canal districts, and I think the explanation is to be found in the increased prosperity of the people which enables them to keep better cattle, and the tracts in which the sub-soil water level has been raised by percolation from the canal offer the greatest advantages for well extension. I have not as yet been able to get the agricultural statistics of the villages in the Aligarh District recently debarred from canal irrigation, but I am confident it will be found that they have even now, very nearly as large a percentage of irrigation from wells, both new and old, as they had formerly from the canal, and this without advances. †

Tracts with artificial high water surface the best for Government wells.

160. There are many advantages gained by selecting such tracts for wells; the water is near the surface, money and cattle plentiful, the best possible drainage system is adopted, and the canal supply can be utilized in places where it is more needed.

* This result is very curious.

† Since received, *vide* Appendix II.

The Bulandshahr District.

161. The Bulandshahr District also offers facilities for extension of well irrigation, particularly in those parts of parganas Ahar, Shikarpur, Sahana and Anupshahr, to which the canal does not reach; the mota is scattered, but suitable positions for wells will be found in most villages; there is plenty of good *dumat* soil, the best for the purpose, *and the existing irrigation is high class.* Mr. S. Growse, C.S., the Collector, kindly obtained the statistics of the worst villages for me; they are too voluminous to be put up with this Report, but will be forwarded to the Director of Agriculture separately.

Advances.

162. Direct Government agency being deprecated, the arrangements for advance and recovery of the interest become matters of great importance. Zemindars do not care to take advances, even if anxious to improve their estates, for they, like Government, are not certain of financial success unless they are self-cultivating, and advances cannot be made to individual tenants for want of security.

How best made.

163. But we find few wells worked by a single cultivator; a community is more stable than an individual, and if joint agreements, fixing shares, &c., between the Zemindar on the one hand and the cultivators interested on the other, were arranged by the advancing officer, the Zemindars in most cases would give the required security, particularly if the interest were not payable as such; but as a fixed charge per acre on the land benefited, the advance being regarded as what it truly is, *viz.*, sunk in the ground for its permanent benefit.

*Khára* wells.

164. The water of certain wells is bitter, called *khára*, which is caused most probably by solution of salts in the soil, as such wells are only found in certain localities, notably Muttra. The water of these wells is said to be good for the rabi, if rain also falls, but not alone, not good for indigo or cotton, but it is always preferred for tobacco.

Kyaries.

165. With reference to canals, attention may be drawn to the great importance of Kyaries, the compartments into which the field is divided, and on which the whole system of distribution depends. The quantity of water used for irrigation per acre by canals is three times as great as by wells, and a strict adherence to Kyaries should result in an enormous extension of area.

Decrease in culturable area.

166. Another point of consideration is the power canal water possesses of bringing culturable land into cultivation; very poor land will often not repay the cost of well water, but the charge is so low, that when canal water is newly introduced into a village it has a strong tendency to lower the percentage of culturable area, if properly distributed, *vide* Appendix VI.

Extract from Diary.

167. A general account of the villages visited is given in Appendix X.

Apology.

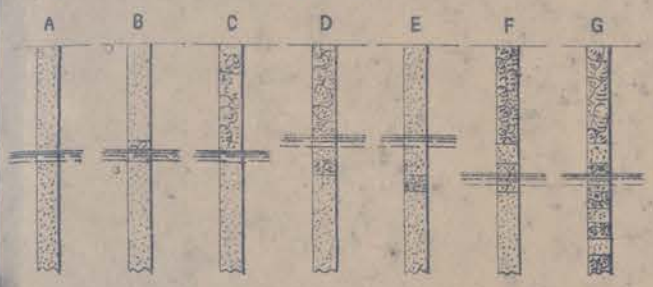
168. In conclusion, I trust that the imperfections and length of this Report will be forgotten in the interest which attaches to the subject. I may add that the letterpress is chiefly explanatory of the Tabular Statements, (which should be studied as containing a careful abstract of all the information collected,) and is no index of the labor bestowed on their preparation.

NAINI TAL,
14*th August*, 1882.

J. CLIBBORN, CAPT., B.S.C.,
*Executive Engineer.*

# IRRIGATION FROM WELLS IN NORTH-WEST PROVINCES AND OUDH.

FIG. 1.




A. Suits kucha wells with Dhenklis.
„ Masonry well unsuccessful.
B. Dry brick or masonry wells.
C. Kucha wells unlined.
D. Masonry or lined kucha wells.
E. „ „ „ „
F. „ „ „ „
G. „ „ „ „

F becomes D in years of heavy rainfall or when canal is opened, and kucha wells suffer, but supply would be increased in masonry wells.

FIG. 2.

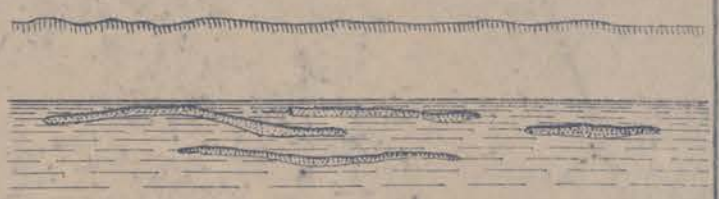


FIG. 4.

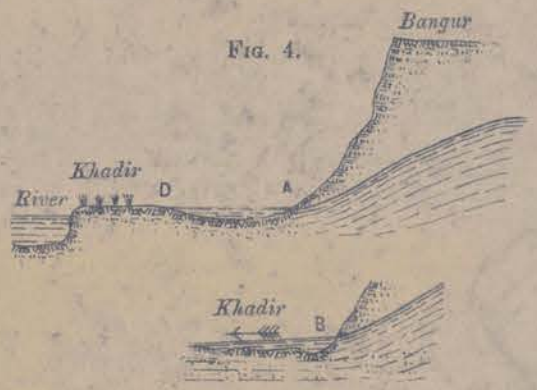



FIG. 3.

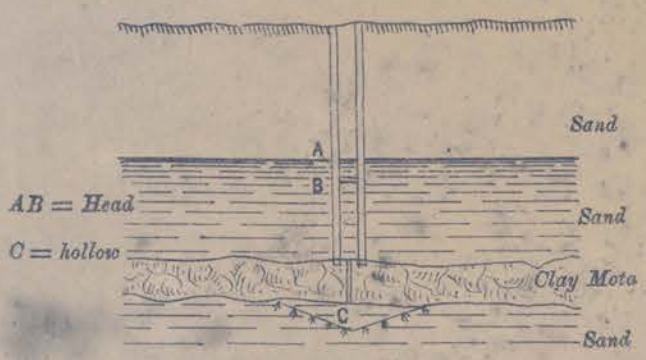



FIG. 6.

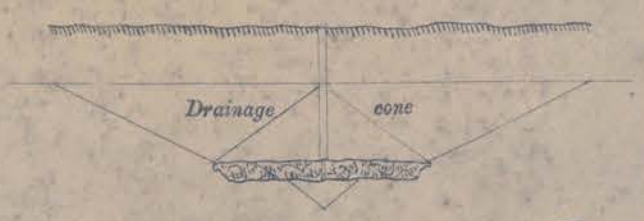



FIG. 5.

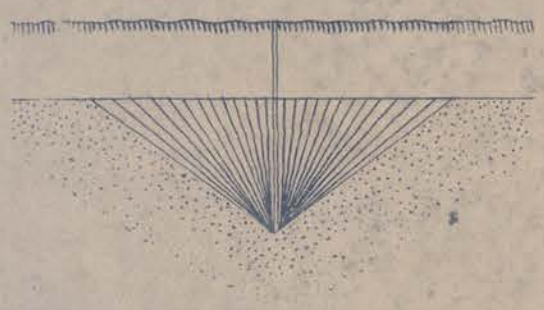


FIG. 8.

FIG. 7.

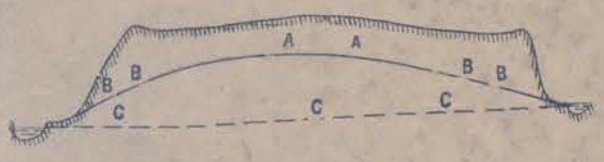
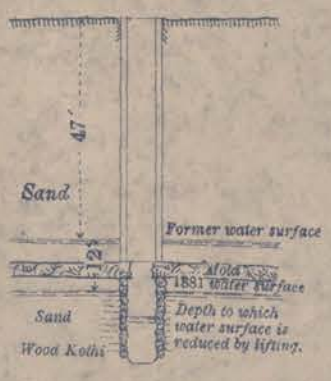



FIG. 10.




Sand,
Clay,
Water,

FIG. 9.

Thc. T. C. Press, Roorkee.

THOS. D. BONA, Supdt.

# IRRIGATION FROM WELLS IN NORTH-WEST PROVINCES AND OUDH.

Village Site FIG. 11.

FIG. 12.

FIG. 13.

FIG. 14.

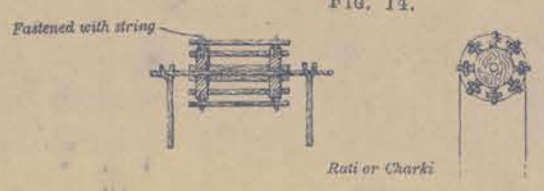



FIG. 15.

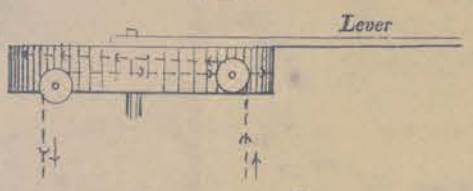



FIG. 16.

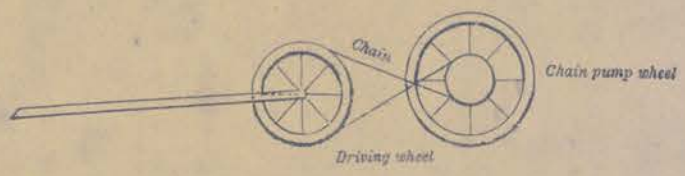



FIG. 17.

FIG. 18.

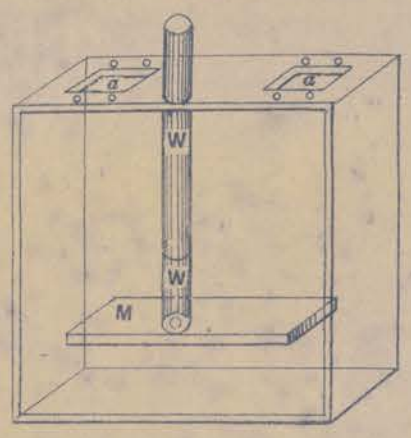



FIG. 19.

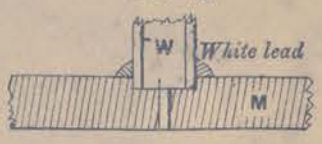



FIG. 20.

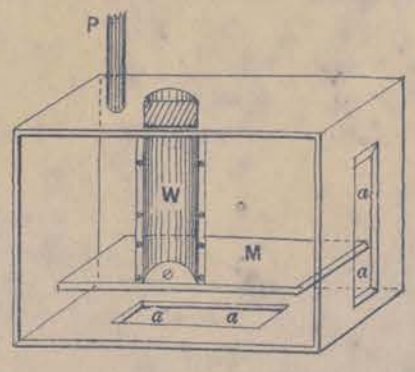
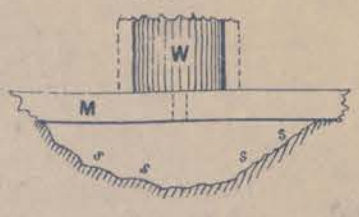



FIG. 21.




Sand,
Clay,
Water.

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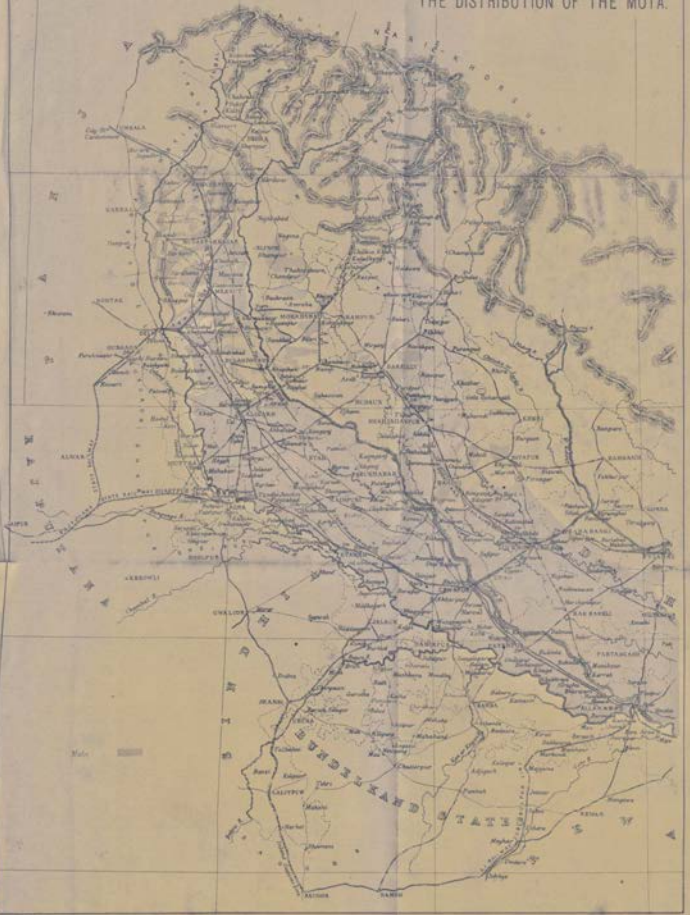
THOS D. BONA, Supdt.

SHOWING ROUGHLY
THE DISTRIBUTION OF THE MOTA.



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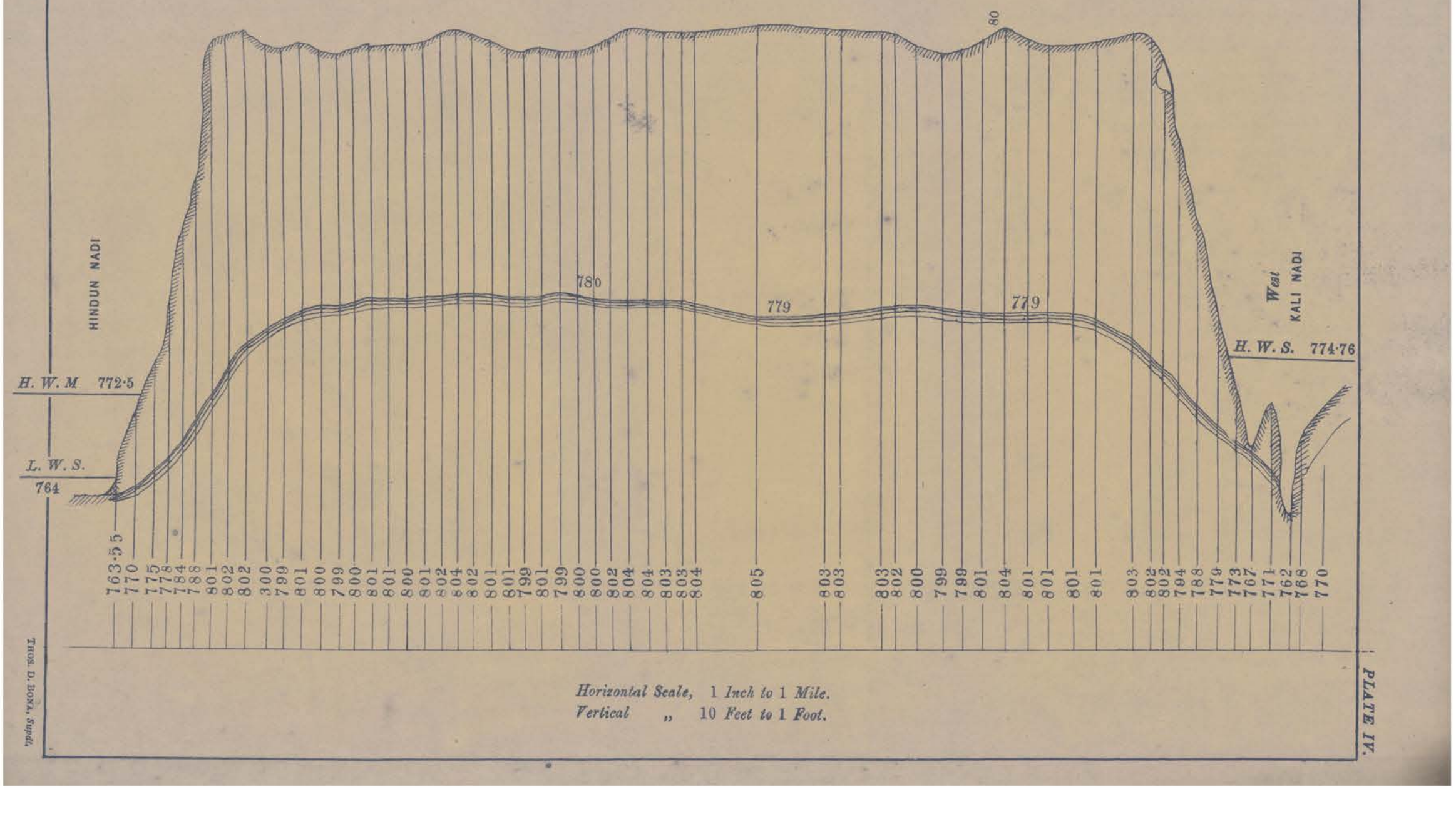
# IRRIGATION FROM WELLS IN NORTH-WEST PROVINCES AND OUDH.

## SECTION ALONG SHAMLI ROAD, DEOBAND DOAB, OPPOSITE MUZAFFARNAGAR,

## TAKEN 1876.




*Horizontal Scale,* 1 *Inch to* 1 *Mile.*
*Vertical* „ 10 *Feet to* 1 *Foot.*

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PLATE IV.

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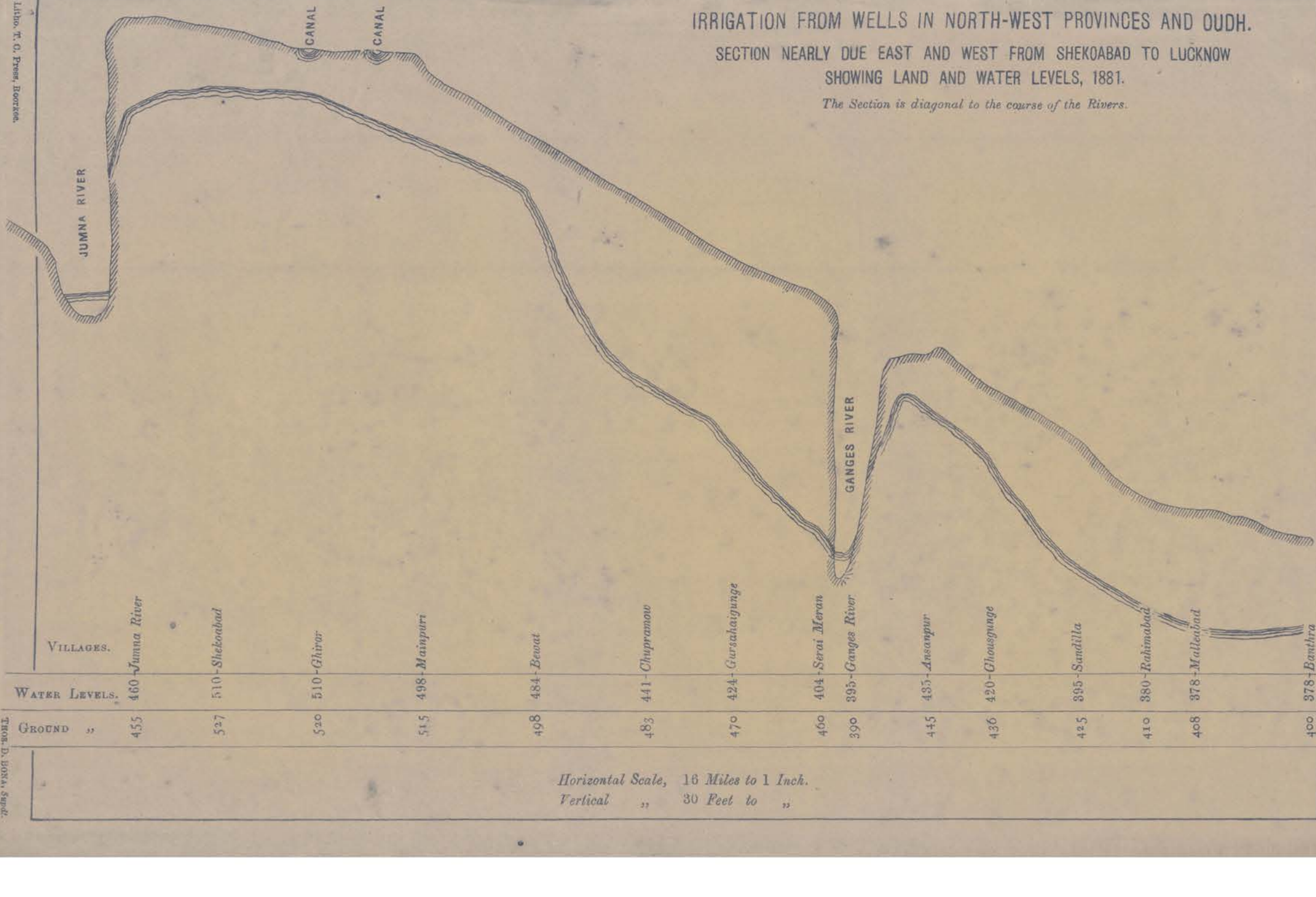
# IRRIGATION FROM WELLS IN NORTH-WEST PROVINCES AND OUDH.

## SECTION NEARLY DUE EAST AND WEST FROM SHEKOABAD TO LUCKNOW SHOWING LAND AND WATER LEVELS, 1881.

*The Section is diagonal to the course of the Rivers.*




| Villages. | | Jumna River | Shekoabad | Ghiror | Mainpuri | Bewat | Chupramow | Gursahaiganje | Serai Meran | Ganges River | Ansangur | Ghousganje | Sandilla | Rahimabad | Malleabad | Banthra |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Water Levels. | | 460 | 510 | 510 | 498 | 484 | 441 | 424 | 404 | 395 | 435 | 420 | 395 | 380 | 378 | 378 |
| Ground „ | | 455 | 527 | 520 | 515 | 498 | 483 | 470 | 460 | 390 | 445 | 436 | 425 | 410 | 408 | 400 |

*Horizontal Scale,* 16 *Miles to* 1 *Inch.*
*Vertical* „ 30 *Feet to* „

PLATE V.

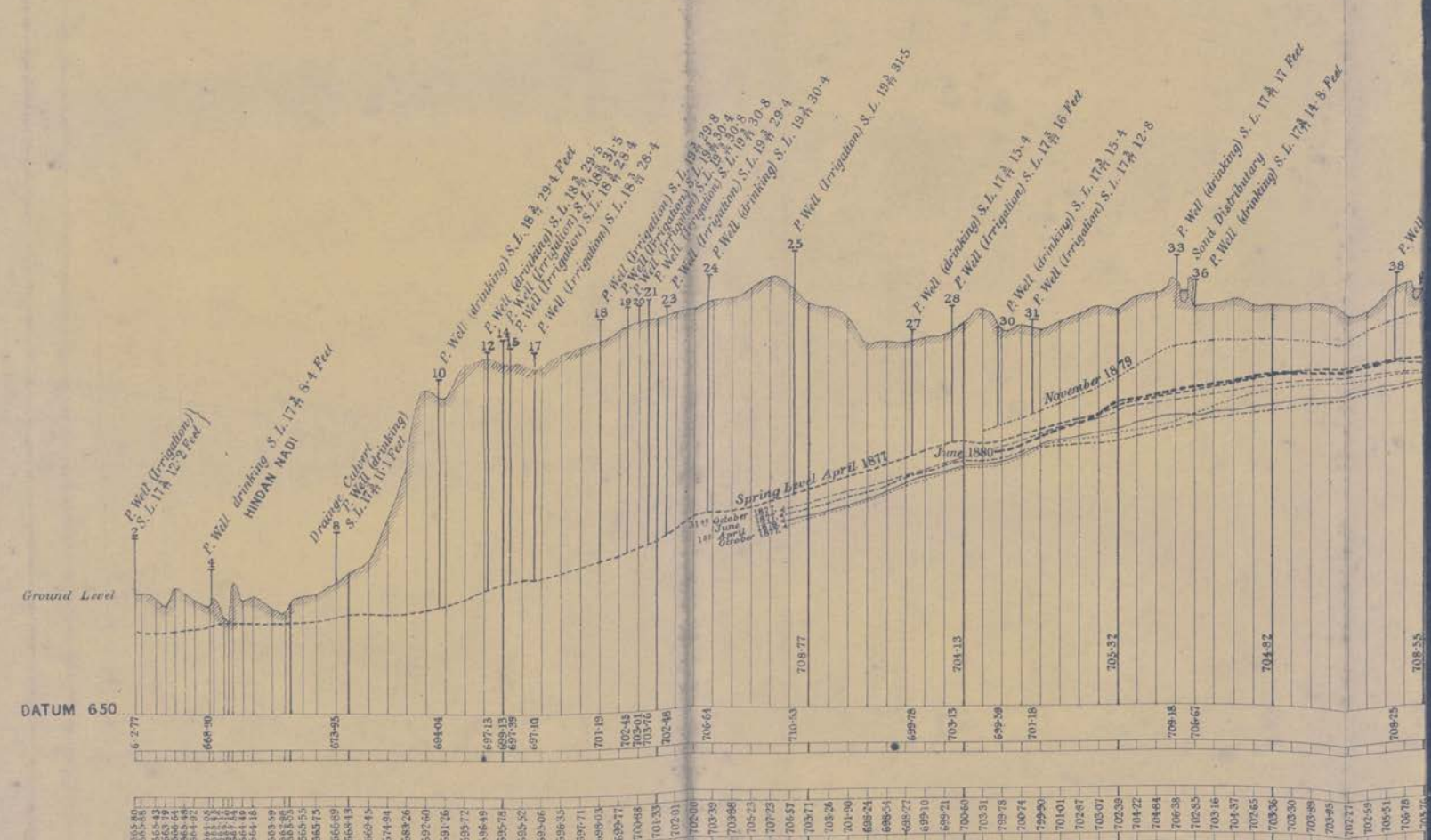
THOS. B. BOSA, Supdt.

# LEVELS OF COUNTRY ALONG MEERUT AND DELHI ROAD, SHOWING THE SPRING LEVEL

## NOVEMBER 1879, (A YEAR OF

HORIZONTAL SCALE, 2 IN

VERTICAL SCALE, 15 F


P. Well (Irrigation) S. L. 17¾ 12·2 Feet
P. Well drinking S. L. 17¾ 8·4 Feet
HINDAN NADI
Drainge Culvert
P. Well (drinking) S. L. 17¾ 11·1 Feet
P. Well (drinking) S. L. 18¾ 29·4 Feet
P. Well (drinking) S. L. 18¾ 29·5
P. Well (Irrigation) S. L. 18¾ 31·5
P. Well (Irrigation) S. L. 18¾ 25·4
P. Well (Irrigation) S. L. 18¾ 28·4
P. Well (Irrigation) S. L. 19¾ 29·8
P. Well (Irrigation) S. L. 19¾ 30·4
P. Well (Irrigation) S. L. 19¾ 30·5
P. Well (Irrigation) S. L. 19¾ 30·8
P. Well (Irrigation) S. L. 19¾ 29·4
P. Well (drinking) S. L. 19¾ 30·4
P. Well (Irrigation) S. L. 19¾ 31·5
P. Well (drinking) S. L. 17¾ 15·4
P. Well (Irrigation) S. L. 17¾ 16 Feet
P. Well (drinking) S. L. 17¾ 15·4
P. Well (Irrigation) S. L. 17¾ 12·8
P. Well (drinking) S. L. 17¾ 17 Feet
Sonal Distributary
P. Well (drinking) S. L. 17¾ 14·8 Feet
November 1879
June 1880
Spring Level April 1877
31st October 1877 4
June 1878 4
14th April 1878 4
October 1878 4
Ground Level
DATUM 650
Mile from Delhi

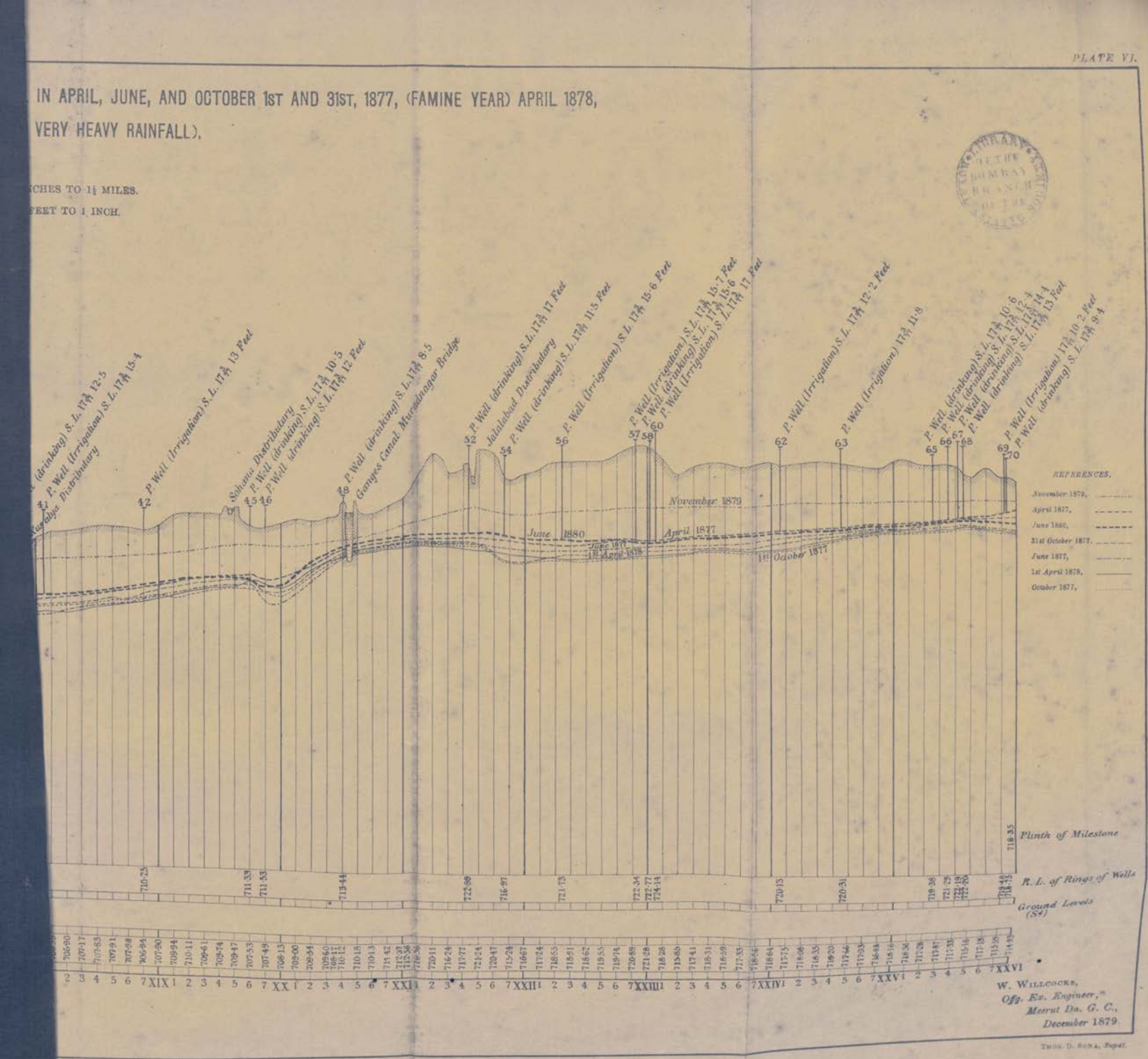
Litho. T. C. Press, Roorkee.

# IN APRIL, JUNE, AND OCTOBER 1st AND 31st, 1877, (FAMINE YEAR) APRIL 1878,

## VERY HEAVY RAINFALL).

CHES TO 1¼ MILES.

EET TO 1 INCH.

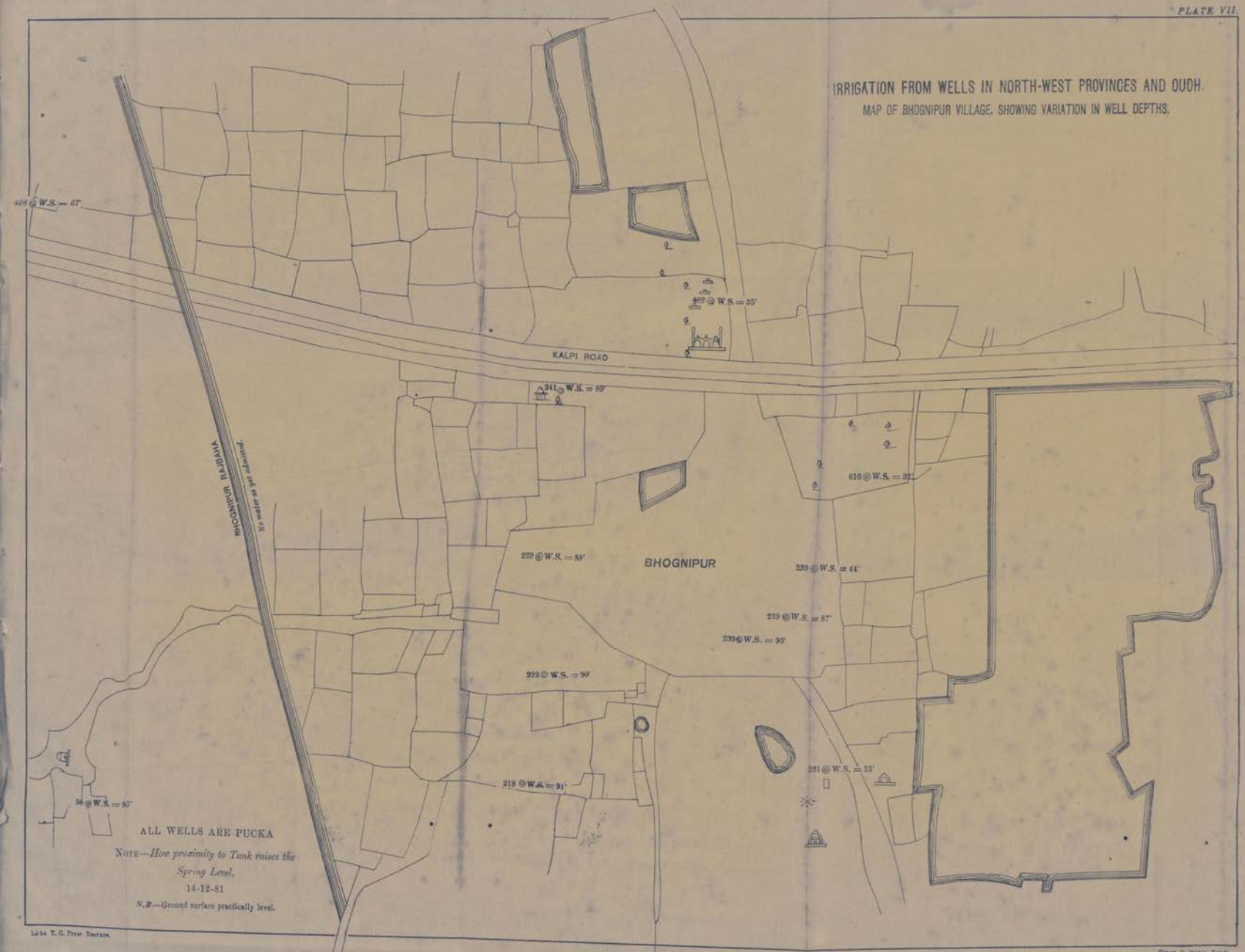

P. Well (drinking) S. L. 17¾ 12·5
P. Well (Irrigation) S. L. 17¾ 15·4
P. Well (Irrigation) S. L. 17¾ 13 Feet
Sohana Distributary
P. Well (drinking) S. L. 17¾ 10·5
P. Well (drinking) S. L. 17¾ 12 Feet
P. Well (drinking) S. L. 17¾ 8·5
Ganges Canal Muraddnagar Bridge
P. Well (drinking) S. L. 17¾ 17 Feet
Jalalabad Distributary
P. Well (drinking) S. L. 17¾ 11·5 Feet
P. Well (Irrigation) S. L. 17¾ 15·6 Feet
P. Well (Irrigation) S. L. 17¾ 15·7 Feet
P. Well (drinking) S. L. 17¾ 15·6 Feet
P. Well (Irrigation) S. L. 17¾ 17 Feet
P. Well (Irrigation) S. L. 17¾ 12·2 Feet
P. Well (Irrigation) 17¾ 11·8
P. Well (drinking) S. L. 17¾ 10·6
P. Well (drinking) S. L. 17¾ 12·4
P. Well (drinking) S. L. 17¾ 14·4
P. Well (drinking) S. L. 17¾ 13 Feet
P. Well (Irrigation) 17¾ 10·2 Feet
P. Well (drinking) S. L. 17¾ 9·4
November 1879
June 1880
April 1877
June 1877
1st April 1878
1st October 1877
REFERENCES.
November 1879,
April 1877,
June 1880,
31st October 1877,
June 1877,
1st April 1878,
October 1877,
Plinth of Milestone
R. L. of Rings of Wells
Ground Levels (S4)

W. WILLCOCKS,
Offg. Ex. Engineer,
Meerut Da. G. C.,
December 1879.

THOS. D. SONS, Supdt.

# IRRIGATION FROM WELLS IN NORTH-WEST PROVINCES AND OUDH.

## MAP OF BHOGNIPUR VILLAGE, SHOWING VARIATION IN WELL DEPTHS.


408 @ W.S. = 67'
KALPI ROAD
BHOGNIPUR RAJBAHA
No water as yet obtained.
487 @ W.S. = 35'
241 @ W.S. = 59'
610 @ W.S. = 32'
239 @ W.S. = 38'
BHOGNIPUR
239 @ W.S. = 44'
239 @ W.S. = 87'
239 @ W.S. = 95'
229 @ W.S. = 90'
218 @ W.S. = 91'
221 @ W.S. = 25'
96 @ W.S. = 85'
ALL WELLS ARE PUCKA
NOTE.—How proximity to Tank raises the Spring Level.
14-12-81
N.B.—Ground surface practically level.

Litho T. G. Prov. Bourse.

Thos. S. Bona, Supdt.

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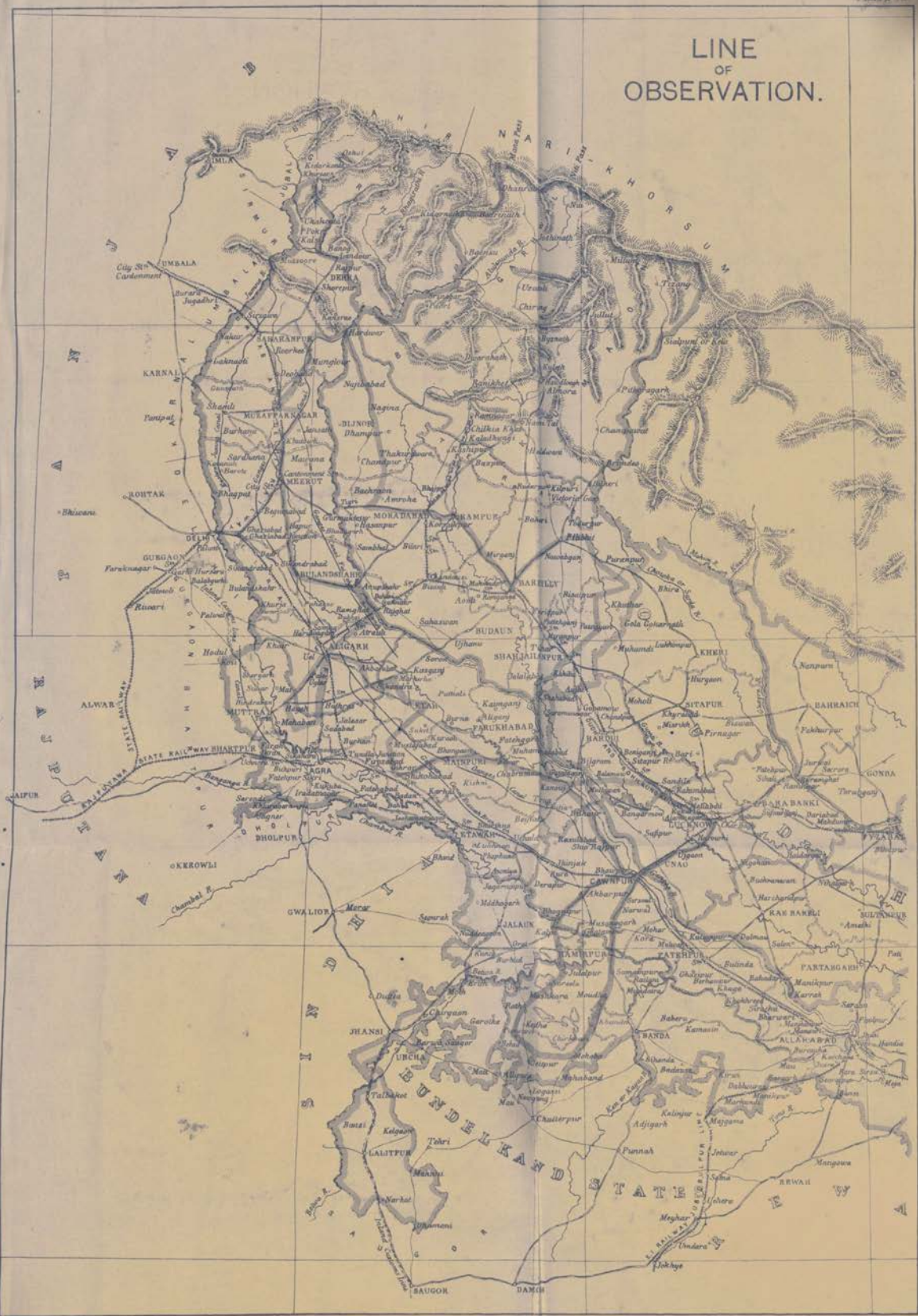
LINE
OF
OBSERVATION.
SIMLA
UMBALA
DEHRA
SAHARANPUR
KARNAL
MUZAFFARNAGAR
BIJNOR
MEERUT
ROHTAK
MORADABAD
RAMPUR
DELHI
GURGAON
BULANDSHAHR
BAREILLY
BUDAUN
ALIGARH
SHAHJAHANPUR
KHERI
ALWAR
MUTTRA
ETAH
FARUKHABAD
SITAPUR
BAHRAICH
AGRA
MAINPURI
BAHDUN
GONDA
JAIPUR
DHOLPUR
KERROWLI
ETAWAH
CAWNPUR
UNAO
RAE BARELI
GWALIOR
JALAUN
HAMIRPUR
FATEHPUR
PARTABGARH
JHANSI
BANDA
ALLAHABAD
URCHA
LALITPUR
REWAH
SAUGOR
DAMOH
Ganges R.
Jumna R.
Chumbel R.
Betwa R.
Ken R.
Sone R.
Gogra R.
Ramganga R.
Kalinadi R.
Hindun R.
Sarda R.
Gumti R.
Rind R.
Pahuj R.
Dasan R.
Jumna Canal
Agra Canal
Ganges Canal
Sirhind Canal
Upper Ganges Canal
Lower Ganges Canal
Upper Jumna Canal
Lower Jumna Canal
Cawnpur Canal
Rohilkund Canal
Sarda Canal
Gogra Canal
Sone Canal
Betwa Canal
Ken Canal
Dasan Canal
Rind Canal
Pahuj Canal
Gumti Canal
Hindun Canal
Kalinadi Canal
Ramganga Canal
Bhagirathi R.
Alaknanda R.
Dhauli R.
Kali R.
Sarju R.
Ramganga R.
Gumti R.
Gogra R.
Sone R.
Ken R.
Betwa R.
Pahuj R.
Rind R.
Dasan R.
Chumbel R.
Jumna R.
Ganges R.

# NOTE

ON THE

# CONSTRUCTION OF WELLS ON THE AWA ESTATE.

BY


## W. J. WILSON,

EXECUTIVE ENGINEER, DEPARTMENT OF AGRICULTURE AND COMMERCE.

# NOTE ON THE CONSTRUCTION OF WELLS IN THE AWA ESTATE.

Two parts of the Awa Estate—both in the Etah District—have been selected by Mr. Crooke for the purpose of commencing a systematic scheme of well construction. One is part of the Jaithra Circle, situated in the Azamnagar Pargana between the Káli Nadi and the Burhganga. The other is the Khwájapur Circle, in the Jalesar Pargana between the Domaria and Sirsa Nadis. The conditions of well construction in the two tracts being very different, I propose to discuss them separately under the following heads:—

1. Description of the wells now used.
2. The area irrigable from a well.
3. The cost of irrigation.
4. The construction of masonry wells.
5. The cost of masonry wells.
6. Report of work done and in progress.

## JAITHRA CIRCLE.

### I. DESCRIPTION OF THE WELLS NOW USED.

2. Two Plates are attached showing the villages in the Jaithra Circle in which wells are being made. *Plate No.* I., which is compiled partly from the Aliganj Tahsil Map and partly from a tracing kindly supplied by Major J. C. Ross, R.E., shows the position of the villages with respect to the Fatehgarh Branch of the Lower Ganges Canal and the Canal Distributaries.

A drainage line passes from the village Pachhenda Paháripur to the north of Dhúmri, through Jaithra and Khiria Lagar Sahai to Targawan, and thence *viâ* Jamlapur into the Káli Nadi. The country between the drainage line and the Káli Nadi is partially irrigated by a system of distributaries of the Fatehgarh Branch of the Lower Ganges Canal.

The tract between the Targawan drainage line and the Fatehgarh Branch is not to be irrigated from the canal at present, but it is probable that the land between the canal and the large dhák jungle will be ultimately irrigated. Throughout this tract the drainage depressions are very marked, but during the rains the drainage lines consist of a series of jhils separated by necks of higher land. During heavy rain the water flows along the drainage lines from one depression to another, but after a few days the flow ceases and the jhils remain full. The soil is generally *bhúr* or light *dúmat*. The surface of the ground is uneven, and the rain water collects in numerous small hollows.

Owing to these circumstances a large proportion of the rainfall sinks into the ground, and at the end of the rains the depth to the sub-soil water from the surface of the ground is from 6 to 8 feet, except in sand hills and locally high places. In the hot months water is usually found from 10 to 12 feet below the surface of the ground, and the villagers say that in a year of drought it falls another 5 or 6 feet.

Well irrigation is very general throughout the tract, and helps to lower the level of the sub-soil water in the rabi season. The introduction of canal irrigation would reduce the area irrigated from wells, and diminish the quantity of sub-soil water removed by them. There is no doubt that the tract has been rightly debarred from canal irrigation.

3. In *Plate No.* I. the debarred tract is colored black, except that part of it which is

included in the Awa Estate, which is colored red. The Estate villages are shown on a larger scale in *Plate No.* II.

The whole of Bahgon, Tigra Bhamora, and Mahaya, about three-fourths of Jaithra, and half of Khiria Lagar Sahai—or about 7,500 acres—are without canal irrigation.

4. The land of these villages is divided into two tracts, which may be called—

(i), the spring well tract, and
(ii), the percolation well tract.

In the former spring wells are easily made by the villagers. It includes a few fields in Jaithra, but is chiefly in Bahgon (*Plate No.* II.)

In Jaithra there is one masonry well built by a cultivator, which reaches the spring. Another well has been sunk, but the "mota" has not been pierced. During last cold weather one kucha spring well was used for irrigation.

In Bahgon during the last rabi 6 pucka spring wells, working 14 buckets, and 26 kucha spring wells, working 39 buckets, were used for irrigation.

In Khiria Lagar Sahai, Tigra Bhamora, and Mahaya, there are no spring wells.

5. The soil sections in the spring wells in Bahgon vary considerably, but as a rule there are from 4 to 9 feet of a sandy loam, called *lelwa*, above the clay. In some wells there is no lelwa, clay being found at or above the percolation level. In others there are two distinct beds of lelwa separated by a stratum of clay.

It is necessary to support the sandy loam by coils of interwoven twigs of arhar, cotton, or dhák, and the villagers say that they cannot make a kucha well if this stratum is more than 9 or 10 feet thick, as the pressure causes the coils of twigs to bulge inwards.

The thickness of the mota is said to vary from 6 to 18 feet, but in some places it is so thick that the villagers have been unable to get through it to tap the spring.

6. The life of a kucha spring well depends on the nature of the upper soil, the thickness of lelwa and the rainfall. It averages from two to three years.

The cost of the well depends on the thickness of the bed of lelwa, which must be supported by coils of twigs; and on the thickness of clay, which must be dug in order to get a sufficient supply of water. It appears to vary from Rs. 3 to 10.

Some of the wells give enough water for one, and others for two buckets.

7. The pucka spring wells are made of block kankar or bricks set in mud. On one of them four buckets, and on six of them two buckets, are worked.

8. In the percolation well tract only two spring wells exist. They are in the Jaithra Indigo Factory, and were built some 60 years ago. One well, 12 feet in diameter, is said to have cost Rs. 1,300; the other, 8 feet in diameter, Rs. 850.

*Figs.* 1 and 2, *Plate No.* IV. are sections of the kucha percolation wells made by the villagers. More than three hundred of these wells were used for irrigation during the last rabi season.

If the soil is sufficiently firm the well is dug in the form of the frustrum of a cone, 4 to 5 feet wide at the top and 9 feet wide at the percolation level (*Fig.* 1). If the soil is too sandy to admit of this, the section shown in *Fig.* 2 is adopted, and the trunk of a *khajúr* tree is laid across the excavation in order to support the woodwork on which the bucket is worked.

A cylinder made of coils of interwoven twigs is sunk from 5 to 6 feet below the percolation level.

The cost of making such a well is difficult to ascertain, but the following appears a fair estimate:—

| | Rs. | A. | P. | | Rs. | A. | P. |
|---|---|---|---|---|---|---|---|
| Earthwork, .. .. .. .. .. | 0 | 10 | 0 | | | | |
| Making 20 to 30 coil of twigs, .. .. .. | 0 | 10 | 0 | to | 0 | 15 | 0 |
| Sinking cylinder, 6 to 8 men for 2 days, at Re. 0-1-0, | 0 | 12 | 0 | | 1 | 0 | 0 |
| Food for madad, .. .. .. .. | 1 | 8 | 0 | | 2 | 0 | 0 |
| Total, .. | 3 | 8 | 0 | to | 4 | 9 | 0 |

The *khâchhis* and other small cultivators club together to make their wells, and no actual cash expenditure is incurred, but the men who have larger holdings employ hired labor.

There is a good deal of difference in the wells. Those sunk in coarse sand give much more water than those in fine sand. The sand that comes into the well is cleared out once or twice a day, and is put on the ledge behind the cylinder. So long as a well remains in good order, the older it is the more water it gives.

The wells are made as soon as the rabi sowings are completed. Last year they were being made as late as the middle of December. Irrigation for the earlier sown rabi crops is frequently required before the wells are ready, and the labor now spent in making the kucha wells would be more profitably employed in irrigating from pucka wells.

The *khâchhis* take care of their wells and sometimes make them last for two years, but by far the greater number of the percolation wells are used for only one season.

9. There are 18 masonry percolation wells in Jaithra, and on three of them two buckets are worked. Some are made of kankar, but most are of under-burnt, wedge-shaped bricks set in mud. They are 6 to 8 feet in diameter, and have been sunk from 10 to 15 feet below the percolation level. They are made only in places where experience with kucha wells has shown the sand to be coarse and to give a good supply of water. They require to be cleared out occasionally.

Their chief advantage is their durability. In a year of drought they give very little water, the cylinders not being deep enough.

10. The water lift in general use in these villages is the single bucket with inclined bullock run. The cattle are worked on the *nágaur* system, the rope remaining attached to the yoke while the bullocks ascend the run. The buckets are small, those which have been measured containing from 14 to 20 gallons. Buckets that have been in use for some time, and have been torn and repaired, contain much less than new buckets. The cattle are much smaller than those used in the Jalesar pargana.

To work one bucket two men are employed; one to drive the bullocks, and the other to fill and empty the bucket. When two buckets are worked on a well the bullock runs are parallel to each other on the same side of the well, and one man is able to attend to both buckets, while the second drives the two pair of cattle. Hence a considerable saving of manual labor is effected by working two buckets on the same well. When four buckets are worked, two are fixed on one side and two on the other side of the well.

The *dhenkli* and *ráhat*, or *charkhi*, are occasionally used by *khâchhis* and small cultivators.

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## II. THE AREA IRRIGABLE FROM A WELL.

11. Tables I. and II. give the area irrigated during last rabi by a number of spring and percolation wells in villages of the Jaithra Circle. The average results obtained are at first sight rather surprising, the area irrigated per bucket from spring wells being 2·32 acres, while from percolation wells it is 2·82 acres. It will be noticed too that the area irrigated from the pucka spring wells was only 1·75 acres per bucket, while from the kucha spring wells it was 2·63 acres.

This is due (i), to some of the masonry wells being in a bad state of repair; (ii), to the

area under rabi round some of the wells being insufficient to keep them constantly at work; and (iii), to the cultivated fields being scattered and at a considerable distance from some of the wells. There is a good deal of *usar* in the spring well tract, and the water is sometimes taken a distance of one or two furlongs through waste land in order to get to a field to be irrigated.

In the percolation well tract there is not much usar. The wells are made after the rabi sowings have been completed, and their positions are chosen with respect to the fields to be irrigated. The area round a percolation well is compact, and is more easily irrigated than the scattered fields round a spring well.

12. The villagers say that if a well gives enough water one bucket can irrigate 20 kucha bigahs, or about 4 acres, in the rabi season, and this area was attained on some of the single-bucket wells. The wells now being made should irrigate 3 acres per bucket, which is very little more than the average obtained from the wells on which irrigation was recorded.

13. In estimating the area *irrigable* from a masonry well, it is necessary to consider the system of cultivation adopted in the fields round the well.

The *gauhan* lands, which are immediately round a village, often yield two crops a year.

The *barha*, or outlying lands, are sown only once a year, and it is customary to alternate kharif and rabi crops. An exception must be made, however, in the case of the *tarai*, or low-lying lands, as, owing to their being under water during the rains, no kharif crop except rice can be sown in them, and it is a common practice to sow rabi crops in these fields every year.

*Manjha* lands appear as a rule to be sown only once a year.

14. The land of a village may, therefore, be divided into two classes:—

A. Fields in which rabi crops are sown every year, comprising the gauhan and tarai.

B. Fields in which rabi crops are sown every second year, comprising the rest of the village.

In fields of class A, the maximum area that can be irrigated from a well is the area that can be irrigated in the rabi season, or 3 acres per bucket. But in fields of class B, the irrigable area is twice the area that can be irrigated in one rabi season, or 6 acres per bucket.

It is assumed that the cultivation round a well in the outlying lands is so arranged that half the land is under rabi and half under kharif crops in each year. If the whole of the land is under kharif one year and under rabi the next year, half the irrigating power of the well will be lost, as the well will only be worked during every second cold season.

15. The irrigation of kharif crops is not taken into account, but it will be seen that this does not affect the result. In the gauhan the fields which are irrigated during the hot weather and rains are also irrigated in the rabi season. In the outlying lands the fields of juar or bajra that may be irrigated were under rabi during the preceding year, and are included in the irrigable area.

Sugarcane is the only kharif crop that requires watering during the cold weather. If any fields round a well are under sugarcane, the area under rabi crops that can be irrigated will be reduced, but the total area irrigable from the well will not be altered.

16. The best size of well to build depends on—

(i), the supply obtainable from the well;

(ii), the relative cost of different sizes; and

(iii), the position of the well with respect to the land to be irrigated.

Othef things being equal, the considerations in para. 14 point to the conclusion that larger wells should be built in gauhan and tarai lands than in the outlying lands of a village. In the latter a four-bucket well can irrigate 24 acres, while in the former an eight-bucket well is required to irrigate the same area. In each case the water must go the same distance,

and there will be the same loss in the water-courses. Hence, if a four-bucket well is the best size for the barha lands, an eight-bucket well is the best size for gauhan and tarai lands.

## III. THE COST OF IRRIGATION.

17. It is not necessary to consider the cost of raising the water, as this must be done whatever kind of well is used. But it has been noticed in para. 10 that considerable economy in manual labor will result from substituting masonry wells working 2, 4 or 8 buckets for the single-bucket wells now used. 318 single-bucket wells were worked last cold weather in the percolation well tract, and two men were required to each bucket. If these wells were replaced by masonry wells, the labor of 318 men would be liberated, and would be available for irrigating the land which is now dry. Roughly speaking, the labor of one man for 3 months would be saved for each bucket irrigating 3 acres, or of one man for one month per acre irrigated.

18. The cost of making a kucha percolation well is given in para. 8 at Rs. 3-8-0 to Rs. 4-9-0, but part of this is home labor, and the actual expense to the cultivator is probably about Rs. 3 per well, or Re. 1 per acre irrigated. If the value of the liberated labor is estimated at Re. 1 per acre, the total saving to the villagers by using masonry wells is Rs. 2 per acre. This may be considered a low estimate of the direct gain that will accrue to the cultivator every year from the construction of masonry wells.

Other advantages are—

(i). The rabi crops can be irrigated as soon as they require water.

(ii). If there is a long break in the rains the kharif crops can be saved.

(iii). In a year of drought the villagers will be nearly as well off for water as in a year of average rainfall.

19. If Rs. 2 per acre is the cultivator's profit from masonry wells each year his rabi crops are irrigated, this represents his annual profit in the case of gauhan and tarai lands, and his two-yearly profit in outlying lands.

I understand that Mr. Crooke has fixed 3 annas per kucha bigah, or very nearly Re. 1 per acre as the general rate of enhancement in the Jaithra Circle, and the preceding calculations show that the direct profits to the cultivator, owing to his not having to make kucha wells, and to the saving in manual labor, are at least equal to this. If the cultivators can pay an enhancement of Re. 1 per acre in outlying lands, they can afford to pay Rs. 2 per acre in gauhan and tarai lands.

20. To sum up for the percolation well tract.

One bucket can irrigate 3 acres of rabi crops in a season.

Gauhan and tarai lands are usually under rabi crops every year. The irrigable area from a masonry well in these lands is 3 acres per bucket.

Fields in the barha are generally sown with rabi crops every second year. The irrigable area from a well in this land is 6 acres per bucket.

Cultivators can afford to pay twice as much enhancement in gauhan and tarai lands as in the outlying lands of a village. If the rate for the latter is fixed at Re. 1 per acre, for the former it should be Rs. 2 per acre.

In this case the enhancement on the land round a well will be Rs. 6 per bucket for all classes of land.

21. I have considered only the cultivator's profit by the substitution of masonry wells for kucha wells. But there are places where the soil below the level of the sub-soil water is either lelwa or very fine sand, which yields so little water that percolation wells are not made. In other places the soil above the water surface is so sandy that kucha wells are made with difficulty, and are too costly to prove remunerative. These lands are now unirrigated, and should bear a higher rate of enhancement than fields in which kucha wells are easily made.

If the surface soil is sandy the area irrigable from the well should be reduced from 6 to say 5 acres per bucket in the barha, and from 3 to 2½ acres in the gauhan.

22. As regards the spring well tract. Kucha wells cost from Rs. 3 to Rs. 10, and last from two to three years. Some give enough water for two buckets; others for only one. The annual cost per bucket appears to vary from Re. 1 to Rs. 3.

Some cultivators have asked to have wells built in this tract, and it may be advisable to make them where the strata of lelwa and clay are thickest. But it is rarely expedient to construct masonry wells in lands where kucha spring wells are easily made. As shown in para. 35, conditions which favor the construction of kucha spring wells may prevent a really efficient masonry well being built.

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## IV. THE CONSTRUCTION OF MASONRY WELLS.

23. The wells in course of construction at Jaithra are of three kinds—

(i). Spring wells in which the masonry steining rests on clay.

(ii). Spring wells in which the masonry cylinder rests on sand, and the supply is obtained through a tube extending from the bottom of the cylinder to the clay.

(iii). Percolation wells, which are entirely in sand, and the steining of which is made of bricks laid dry, so that water may filter through the joints.

The principles which regulate the construction of each kind of well may be briefly noted.

24. *Spring wells in which the masonry steining reaches clay.*—These wells obtain their supply from a bed of sand underlying an impermeable stratum below the level of sub-soil water. It is not necessary that the impermeable stratum should be continuous over a large area, and instances are common of good springs being obtained by piercing a clay stratum extending over a few bighas.

*Fig.* 3, *Plate No.* IV., shows a well sunk into clay and obtaining its supply from the sand below. As the water in the well is removed, the supply is maintained by water coming in through the hole in the clay. At first some sand comes into the well with the water, and it is probable that a basin-shaped reservoir (shown by the dotted line) is formed, of which the clay acts as the roof. The size of the reservoir increases until the velocity of the water filtering into it from the sand becomes so small that the sand is not disturbed.

If this explanation of the action in an ordinary spring well is correct, it is evident that so long as the clay stratum is of sufficient extent to allow a reservoir to form beneath it, and is strong enough to support the well above it, a supply of water will be obtained without sand coming into the well.

The term " mota " is applied to the stratum of clay, or of clay and kankar, by piercing which a supply of water is obtained. In Majhola, a village near Jaithra, there are some wells which rest on a stratum of nodular kankar without clay, and which give sufficient water for two buckets without sand coming in. But it is rare that such a stratum is found of sufficient thickness and with the nodules close enough together to form an efficient " mota."

25. An ordinary spring well consists of two parts—

(i), the masonry cylinder, and

(ii), the hole through the clay.

The masonry cylinder is simply a cistern in which the buckets work, and its diameter is regulated by the number and size of the buckets. The first wells made at Jaithra were 5 feet in diameter, and were intended to work two buckets; but it was found that two of the small buckets used there could be worked in a well 4½ feet in diameter, and that a 6 feet well would take four buckets. To decide the point four buckets were fitted on a well 6 feet in diameter, and a number of cultivators assembled to see the buckets worked; they decided that the well was large enough.

The cylinder must be sunk to such a depth that it will contain sufficient water in a year of drought. When a well is worked, the water in it should not fall more than 10 feet, and if the supply is copious the fall will be much less. There should be at least 4 feet of water remaining in the well to allow the buckets to be properly filled. Hence the cylinder should be sunk 14 feet below the level of sub-soil water in a dry year. The cultivators at Jaithra say that they have never known the water to fall more than 5 or 6 feet below the ordinary hot weather level. It should, therefore, be sufficient to sink the wells 20 feet below the average percolation level in the hot season. But as the water may fall lower in a year of drought than the cultivators say, it is proposed to sink the cylinders 25 feet.

26. The spring is generally tapped by simply piercing the clay. But there is sometimes too great a thickness of clay to admit of this; or, after getting through some feet of clay, a stratum of loam, or a thin stratum of sand, may be reached, beneath which lies the true "mota." In these cases it is necessary to sink a small shaft through the upper part of the clay, or through the loam, and to line it with brickwork (*Fig.* 4, *Plate No.* IV.)

27. *Spring tube wells.*—In places where the clay stratum is too deep to be reached by the masonry steining, a spring well can be made by sinking a pipe from the bottom of the cylinder to the clay (*Fig.* 5, *Plate No.* IV.)

In order to keep the sand, on which the curb rests, from coming into the cylinder, it is necessary to ram a plug of concrete about 5 feet thick in the bottom of the well between the pipe and the steining. To allow for this the cylinder should be sunk 30 feet below the ordinary percolation level.

At Moradabad the tubes used in the wells have been made of *gúlar* wood, which is known to be very durable under water. At Jaithra all the *gúlar* trees in the Estate villages have been cut down for making curbs, and there are very few trees available for making the tubes. It is proposed, therefore, to use cast-iron tubes with spigot and faucet joints held together by screws. They are much more expensive than wooden tubes, but Mr. Meares reports that he finds great difficulty in sinking the latter through sandy soil containing nodular kankar. In some of the trial borings at Jaithra such a stratum has been found overlying the clay, and it is absolutely necessary to get through it, and to bed the tubes firmly into the clay. The cast-iron pipes will go through nodular kankar much more readily than wooden tubes will, and this advantage may more than compensate for their additional cost.

This description of well is analogous to the well with the small shaft shown in *Fig.* 4. If the main cylinder of the well is bedded in clay, it is generally easy to bale out the water and to dig the shaft; and the masonry lining is nearly as cheap, and is certainly more durable than the iron or wooden pipe. But if the cylinder rests in sand, it is much easier to sink a pipe through the sand to the clay than to sink a small masonry shaft. The main cylinder of the well might be carried down to the full depth of the small shaft or pipe, but this would be both useless and very expensive.

28. The diameter of the pipe is a most important point to determine.

When a spring well is worked, the water level falls until the water enters the well at the rate at which it is withdrawn by the buckets. The fall represents the head expended in overcoming the resistance to the flow of the water; (i), through the sand from which the supply is drawn; and (ii), through the well. The former resistance varies with the degree of coarseness of the sand. The coarser the sand, the more readily will the water flow through it, and the less will be the loss of head. The head lost in the well may be calculated by assuming the water to flow from a reservoir below the clay through the tube into the masonry cistern in which the buckets work. The velocity in the reservoir below the clay, and in the masonry cistern above the tube, is very small and may be neglected.

The hole in the clay in an ordinary well corresponds to the tube in a deep well, and as the diameter of the hole can easily be made as large as desired, and the length is generally small, the loss of head in the well is inconsiderable, and the fall of the water when the well

is worked nearly represents the head expended in overcoming the resistance to the flow of water through the sand below the "mota."

But the following calculations show that in a tube well the loss of head caused by using too small a pipe may be very great—

Let $v$ = velocity of water through the tube in feet per second.
$h$ = head due to the velocity = $\frac{v^2}{64{\cdot}4}$.
$l$ = length of tube in feet.
$d$ = diameter of tube in feet.

The head lost in the well is expended in three ways—

1. A portion of head, which experiment shows is equal to 0·505 $h$, is employed in overcoming the resistance at the lower end of the tube.

2. A portion, which is equal to $h$, is wasted in eddying motion in the masonry reservoir at the upper end of the tube.

   The loss of head at the two ends of the tube is therefore equal to 1·505 $h$.

3. The head expended in overcoming the friction of the tube is equal to $c \frac{4l}{d} h$, where $c$ is a co-efficient which has been found by experiment.

The values of these quantities for pipes 50 and 100 feet in length, and of different diameters, and discharging $\frac{1}{4}$, $\frac{1}{3}$ and $\frac{1}{2}$ cubic foot per second, are given in Table IV.

The values of $c$ are those found by Darcy for old and incrusted pipes, and are double the co-efficients for new and clean pipes (Unwin's Hydraulics).

Experiments have shown that the maximum discharge from a 6 feet well worked by bullocks may be taken at 900 cubic feet per hour, or 0·25 cubic foot per second; and from an 8 feet well at 1,800 cubic feet per hour, or 0·5 cubic foot per second. These discharges are rarely obtained by the villagers. If men are employed to work the buckets, 1,200 cubic feet per hour may be raised from a 6 feet well.

It will be seen from the Table that a 3-inch pipe is quite unsuitable for any but the smallest wells. With a discharge of 0·25 cubic foot per second, 4·90 feet of head are lost in 50 feet of 3-inch pipe while only 1·15 foot is lost in a 4-inch pipe of the same length; the difference is nearly 4 feet. With a discharge of 0·5 cubic foot per second, the head lost in 50 feet of 3-inch pipe is 19·58 feet, and in a 5-inch pipe of the same length it is only 1·51 foot; the difference is 18 feet.

The diameter of the pipe should be regulated by its length, and by the size of the well. But it is convenient to have a standard size, and the 5-inch pipe appears most suitable for irrigation wells.

With a discharge of 0·5 cubic foot per second, the head lost in 100 feet of 5-inch pipe is 2·71 feet, and in the same length of 6-inch pipe it is 1·09 feet. The difference is 1·62 feet. If iron pipes are used, the difference in cost between pipes 6 inches and 5 inches in diameter is probably greater than the cost of sinking the main cylinder of the well an extra 2 feet, which will more than allow for the additional loss of head (1·62 feet) caused by using the smaller pipe.

29. *Percolation wells.—Fig.* 6, *Plate No.* V., is a section of the percolation wells which it is proposed to build. In the lower 5 feet of the steining the bricks are set in mortar; above this the bricks are laid dry to a height of 4½ feet. This is succeeded by 1 foot in which the bricks are laid in mortar; this again by 4½ feet, consisting of bricks laid dry; and so on till the cylinder has reached a height of 26 feet; above which to the top the bricks will be set in mortar. The cylinder will be sunk 30 feet and a plug of concrete 5 feet in thickness will be put into it.

30. A paper read by Mr. Sutcliff before the Society of Engineers in December 1877, describes the systems that have been tried in England in order to obtain a supply of water

from tube wells sunk in sand. These wells, commonly known as the "Abyssinian tube wells," consist of wrought-iron tubes connected by screwed sockets, the lowest tubes being furnished with steel points and perforated with holes varying from $\frac{1}{8}$ to $\frac{1}{4}$ inch in diameter, extending from 15 inches to 3 feet upwards from the points. The tubes are driven into the ground until a stratum is reached that will yield water. A pump is then attached to the top of the tubes, and on working the pump water is drawn in through the percolations in the lowest tube and is discharged above the surface of the ground. When the lowest tube is in a stratum consisting entirely of fine sand it soon becomes choked, and the sand flows in through the perforations as fast as it is cleared out. The following extract from Mr. Sutcliff's paper, which describes some of the plans that have been adopted to overcome this difficulty, is interesting:—

"A tube well was driven at Chislehurst into an extremely fine sand, and it was found impossible with the horse-hair strainer to get any supply of clear water. The tubes were withdrawn, and the point screwed off, and the pipe driven in the same hole. The pump was then screwed to the top of the tubes, and four or five barrow-loads of sand pumped up. Previously to doing this, however, six barrow-loads of good clean sharp grit gravel were brought to the spot. The pump was removed, and down the tube, which was only $1\frac{1}{4}$-inch internal diameter, as much gravel was forced ramrod fashion as filled up the cavity made by the removal of the sand. The open tube was then withdrawn and a pointed and perforated tube driven into the gravel bed thus formed. A coarse sand tube was dropped into the well to keep back the grit, and upon again attaching the pump the water came freely, and rapidly cleared. *Fig.* 7, *Plate No.* V. shows the bed of gravel inserted in the manner described. In consequence of the success of this well another was sunk on the same estate with equally satisfactory results, and these two wells have now been in use over two years, and within the last few weeks a third has been added. At Orpington, in Kent, what is known as a blowing sand was dealt with somewhat similarly. Owing to the nature of the sand a cavity could not be made in it as in the previous case. A hole 6 or 7 inches in diameter was therefore bored and piped down with large tubes, until several feet of the quicksand had been passed through. The quicksand was removed from the pipes with an ordinary boring shell, and gravel was rammed down, the large tubes being gradually withdrawn as the work progressed. The small $1\frac{1}{4}$-inch tube was then driven into this vertical gravel bed as shown in *Fig.* 8, *Plate No.* V., and a good well made, which gave a supply of about 200 gallons per hour. Clay was rammed tightly over the gravel to prevent drainage contaminating the well. The large tube was entirely dispensed with before completing the work.

"Another method of introducing a gravel bed was employed in a dug well at Lewisham in Kent. The dug well became dry last summer, and to obtain a fresh supply a tube well was driven below the bottom of it, and water in a fine silver sand obtained. Gravel was thrown into the dug well, and by its weight gravitated to the spot from which the sand was being drawn. The operation of pumping out the sand and replacing it with gravel was continued until the water became entirely free from sand, and was so plentiful that two pumps were attached to it and the next house supplied from it."

From the description of the system adopted at Orpington, it appears that when the tube was surrounded by a layer of gravel, a discharge of 200 gallons ( $=$ 32 cubic feet) per hour was obtained without any sand coming into the well.

31. Mr. Bull, C.E., has built some wells in which all the bricks from the curb to within a few feet of the ground level are laid dry, and it is said that little or no difficulty is experienced from the sand coming in through the joints. The character of the sand in different wells varies very much, but there can be no doubt that if the steining of a percolation well can be completely surrounded by a layer of small material, such as broken brick (*Fig.* 6, *Plate No.* V.) the efficiency of the well will be greatly increased.

In 1880 two percolation wells were sunk, but they reached clay within 19 feet of the level of sub-soil water. The area of the surface through which the water can filter is, therefore, much less than in the wells now under construction. The wells gave sufficient water for one bucket without much sand coming in, but when two buckets were worked the

wells rapidly silted up. The earth round one of the wells was cleared out and a trench about 3 feet wide was dug round the cylinder to a depth of 1 foot 6 inches below the percolation level. Lime siftings and broken brick were thrown into the trench. A pump raising almost as much water as two small buckets was worked for a fortnight, when it broke down and was replaced by a smaller pump, which was worked for two months. The result was that very little sand came into the well, while the material in the trench sank a few inches. Had this plan been adopted immediately after the well was built, it is probable that the broken brick would have sunk more rapidly. It will be tried on one or two of the new wells, and if the results are not satisfactory, a somewhat similar plan to that described by Mr. Sutcliff as having proved successful at Orpington will be adopted.

A pipe 6 inches in diameter will be sunk about 6 inches from the steining to a depth of 25 feet. Small brick ballast will be rammed into the pipe and forced into the sand at the bottom. The pipe will be withdrawn, and as it rises more broken brick will be rammed into it. It will be necessary to sink the pipe in 12 or 15 places at intervals of about 2 feet round the steining. In this way the cylinder should be completely surrounded by broken brick to a distance of from 12 to 18 inches; more of the ballast will be filled into a trench round the well.

32. The filter beds generally used in waterworks for the supply of towns consist of a layer of gravel covered with a layer of sand, and they are generally designed with an area of one square yard for each 700 gallons (= 112 cubic feet) of water to be filtered in 24 hours. This is at the rate of nearly 5 cubic feet per square yard per hour.

The steining of a percolation well with the broken brick and sand round it forms a filter bed. When the well is worked the water will fall a few feet, say 4 feet; and if the well has been sunk 30 feet below the percolation level, and the concrete plug is 5 feet thick, the length of the cylinder through which the water can filter will be 21 feet. If there is a foot of brick ballast all round the steining the area of the outside of the cylinder of broken brick will be

$$21 \times 3\tfrac{1}{7} \times 10 = 660 \text{ square feet,}$$
$$= 73 \text{ square yards nearly.}$$

If the water passes into the broken brick from the sand at the rate generally allowed in filter beds, the quantity obtainable from the well will be

$$73 \times 5 = 365 \text{ cubic feet per hour,}$$

or fully enough to supply two of the buckets used at Jaithra.

The velocity of flow through a filter bed is kept very low in order to remove all the mechanical impurities and to oxidize the organic impurities present in the water, and it is probable that a much higher velocity may be permitted without drawing sand into the well. If a rate of 10 cubic feet per square yard per hour can be attained, the well will give sufficient water for four buckets.

33. It remains to consider the effect of a year of drought on these wells. By sinking the cylinder of a spring well 30 feet, allowance is made for a fall of the water surface to the extent of 11 feet in a dry year. If such a fall occur, the length of cylinder of a percolation well through which the water can filter will be reduced from 21 feet to 10 feet, and a discharge at the rate of 20 cubic feet per square yard per hour will be required to supply four buckets. If this rate cannot be attained without bringing sand into the well, either the cylinder must be sunk deeper or the discharge from the well must be reduced.

34. The figures given above show the advantage obtained by making the side of the cylinder permeable to water. If the bricks of the steining are laid in mortar the well must obtain its supply entirely from the sand at the bottom. By throwing broken brick into the bottom of a 6 feet well, a filter bed, having an area of 3 square yards, will be formed, and at the rate of 5 cubic feet per square yard, the discharge will be 15 cubic feet per hour. Even if the rate of discharge can be increased to 20 cubic feet per square yard per second without bringing in sand, the well will not be of much use for irrigation purposes.

It may be possible to form a larger filter bed by throwing the brick ballast outside the steining instead of into the well. By working the well the sand will be drawn into it, and the broken brick will sink and accumulate round the curb. But the well itself will sink during the process, and there is great danger of its being broken and rendered entirely useless; and it is not probable that a sufficiently large filter bed can be formed in this way to give the quantity of water required.

35. It has been stated that in order to ensure an ordinary spring well giving sufficient water in a year of drought, the cylinder should be sunk 25 feet below the average percolation level. This allows for a fall in the level of sub-soil water to the extent of 11 feet during a year of drought, and an additional fall of 10 feet when the well is worked, and there will still be sufficient water in the well to fill the buckets. It is quite possible that the fall of the water surface, both in a year of drought and during the working of the well, is over-estimated; but no exact information is to be had about the former, and until the wells have been made the latter fall cannot be ascertained.

In some cases the depth and thickness of the "mota" are such as to prevent the cylinder being sunk the full 25 feet. For instance, if the bottom of the clay stratum is only 15 feet below the percolation level, and if 3 feet of clay are left beneath the curb, the cylinder cannot be sunk more than 12 feet. Such a section is very suitable for making kucha wells, but not for masonry wells.

The section shown in *Fig.* 3, *Plate No.* IV. is one of the most favorable for the construction of pucka wells. The clay is 20 feet below the percolation level and 10 feet thick. Hence, the cylinder may be sunk 5 feet into the clay, which is enough to keep the sand out of the well; and there is a sufficient thickness of clay below the curb to ensure the stability of the well.

If the "mota" is more than 25, but less than 30, feet below the level of sub-soil water, the cylinder must be sunk to it.

36. Considerable difficulty is found in sinking the wells into the clay. Where the "mota" is more than 12 or 15 feet from the percolation level, and the soil above it is sandy, the wells constructed by the natives are rarely sunk into the clay. A wooden cylinder is constructed 4 feet 6 inches to 5 feet 6 inches in length, with an outside diameter 6 inches less than the diameter of the well. The well having been sunk as deep as it will go, the wooden cylinder is driven 12 to 18 inches into the clay, and lime siftings are rammed by means of iron rods into the space between the steining of the well and the wooden cylinder. When this is done no sand can get into the well from beneath the curb, the water can be baled out, and the clay can be pierced to tap the spring.

If the clay is more than 25 feet below the percolation level there appears to be no objection to this system, and if a small masonry shaft is built inside the wooden cylinder the efficiency of the well will not be impaired by the wood rotting. But when the clay is less than 25 feet deep, the steining should be sunk into it to ensure a sufficient supply of water being obtained in a dry year.

To cut the clay a tool called a *habsa* is used, consisting of a stout wooden pole 20 to 30 feet in length, to the lower end of which two pieces of iron are fixed at such an angle that when the pole is upright against the side of the well they project under the curb. A round hole is first made in the clay by means of the jham. The "habsa" is fixed upright in this hole, and is raised and lowered so as to cut away the sides. The clay that is cut is afterwards dug out by means of the jham. The process is slow and costly, and can probably be improved.

37. If the mota is more than 30 feet below the level of sub-soil water, either a spring tube well or a percolation well should be built, and until both kinds have been made and tested, and their cost and the quantity of water obtainable from them are known, the question as to which description of well is the best for a given locality cannot be answered. At Moradabad a pipe has been sunk over 100 feet, and at Jaithra two borings have been made over

80 feet below the water level without reaching clay. Unless a very cheap description of pipe is used it will rarely pay to build spring wells in places where the "mota" is more than 50 feet deep, and it is in these places that the greatest necessity exists for good percolation wells.

## V. THE COST OF MASONRY WELLS.

38. *Spring wells with cylinders resting on clay.*—Cylinders 6 feet in diameter are made 1 foot thick. The bricks are made segmental to fit the curve of the well, their mean dimensions being 12″ × 6″ × 3″. Two moulds are used—one for headers, the other for stretchers.

One foot in length of the cylinder contains 22 cubic feet of masonry, and at Rs. 20 per 100 cubic feet, costs Rs. 4-6-6.

The cost of sinking varies very much. Through lelwa, the progress is much slower than through sand. Getting the cylinder into the clay is expensive, and more wells must be sunk before the average rate can be ascertained, but it should not exceed Rs. 3 per foot.

The curbs of wells that are sunk into clay are fitted with iron shoes to facilitate the sinking.

The depth to the percolation level from the surface of the ground averages about 12 feet.

39. The estimated cost of a well, the cylinder of which is 6 feet in diameter, sunk 25 feet below the percolation level, and built to a height of 2 feet above it, is as follows :—

| | Rs. | A. |
|---|---|---|
| Curb, fitted with iron shoe, .. .. .. .. | 30 | 0 |
| Masonry cylinder, 39 feet, at Rs. 4-6-6 per foot, .. | 171 | 14 |
| Sinking, 25 feet, at Rs. 3 per foot, .. .. .. | 75 | 0 |
| Earthwork, .. .. .. .. .. | 10 | 0 |
| | 286 | 14 |
| Establishment, at Rs. 10 per cent., .. .. .. | 28 | 11 |
| Tools and plant, at Rs. 5 per cent., .. .. .. | 14 | 6 |
| Contingencies, .. .. .. .. .. | 20 | 1 |
| Total Rs., .. | 350 | 0 |

If a small shaft, 10 feet in length, is required in the clay, the cost of this must be added. The masonry lining may be 3 feet in diameter and 6 inches thick. One foot in length contains 4·5 cubic feet, and costs Re. 0-14-6. The cost will be—

| | Rs. | A. |
|---|---|---|
| Curb, .. .. .. .. .. .. | 5 | 0 |
| Masonry lining of shaft, 10 feet, .. .. .. | 9 | 1 |
| Sinking shaft, .. .. .. .. .. | 10 | 0 |
| | 24 | 1 |
| Add for establishment, tools and plant and contingencies, .. | 5 | 15 |
| Cost of shaft, .. | 30 | 0 |

Hence the total cost of the well will be Rs. 380.

If these small shafts are required in half the wells, the average cost of the spring wells, 6 feet in diameter, will be Rs. 365.

In a previous note on the Jaithra wells the average cost of a 5 feet well was estimated

at Rs. 250. A 5 feet well will take only 2 buckets, while a 6 feet well will take 4 buckets. A four-bucket well at Rs. 365 is cheaper than a two-bucket well at Rs. 250.

40. These wells may be made more cheaply if the cylinder is not sunk so deep, or if its thickness is decreased.

The reasons for sinking the cylinders 25 feet have already been given (paras. 25 and 35).

The thickness of the steining may probably be reduced to 10 inches without endangering the stability of the well. This will effect a saving of about Rs. 25.

The cylinder is strained most severely while it is being sunk, and if it is strong enough to stand sinking, and is properly bedded in the clay, it is not likely to fail when it is used for irrigation. Some cylinders 8 feet in diameter and 12 inches thick will shortly be sunk, and if they go down safely, the steining of the 6 feet wells will be reduced to 10 inches.

41. No 8 feet wells have yet been made at Jaithra, but two sizes of bricks have been burnt for them.

(i). 10 inches long, suitable for cylinders 15 inches thick.

(ii). 12 inches long, suitable for cylinders 12 inches thick.

One foot in length of an 8 feet cylinder, 15 inches thick, contains 36·3 cubic feet of masonry, and at Rs. 20 per 100 cubic feet, costs Rs. 7-4-2.

The sinking should not cost more than Rs. 4 per foot.

The estimated cost of an 8 feet well, sunk 25 feet below the percolation level, and built to a height of 14 feet above it, is as follows:—

| | RS. | A. |
|---|---|---|
| Curb, fitted with iron shoe, .. .. .. .. | 45 | 0 |
| Masonry cylinder, 39 feet, at Rs. 7-4-2 per foot, .. .. | 283 | 3 |
| Sinking 25 feet, at Rs. 4 per foot, .. .. .. | 100 | 0 |
| Earthwork, .. .. .. .. .. | 15 | 0 |
| | 443 | 3 |
| Establishment, at Rs. 10 per cent., .. .. .. | 44 | 5 |
| Tools and Plant, at Rs. 5 per cent., .. .. .. | 22 | 3 |
| Contingencies, .. .. .. .. .. | 30 | 5 |
| | 540 | 0 |

If a shaft 10 feet deep is sunk in the clay, the additional cost will be almost the same as for a 6 feet well, or Rs. 30, and the total cost of the well will be Rs. 570.

The average cost of the 8 feet wells will be about Rs. 555.

If the cylinder is made 12 inches thick, a saving of Rs. 50 will be effected.

42. To compare the cost of a 6 feet well with that of an 8 feet well.

A 6 feet well costs from Rs. 340 to Rs. 365 according as the cylinder is made 10 inches or 12 inches thick.

An 8 feet well costs from Rs. 505 to 555 according as the cylinder is made 12 inches or 15 inches thick.

Hence an 8 feet well costs almost exactly half as much again as a 6 feet well, while it will take twice the number of buckets.

43. *Spring tube wells.*—One of these wells differs from an ordinary spring well in the following details:—

(i). The cylinder is 5 feet longer.

(ii). It is sunk 5 feet deeper.

(iii). There is a plug of concrete, 5 feet thick, in the bottom of the well.

(iv). A pipe extends from about 2 feet above the concrete to the clay.

The rate for sinking should be less than in the other wells, as sand only or sand with a little nodular kankar is passed through. There is no necessity to have the curb shod with iron.

44. The estimated cost of the cylinder of a 6 feet tube well is as follows :—

| | RS. | A. |
|---|---|---|
| Curb, .. .. .. .. .. | 18 | 0 |
| Masonry cylinder, 12 inches thick, 44 feet, at Rs. 4-6-6, .. | 193 | 14 |
| Sinking, 30 feet, at Rs. 2 per foot, .. .. | 60 | 0 |
| Earthwork, .. .. .. .. | 10 | 0 |
| Concrete, 142 cubic feet, at Rs. 14 per 100 cubic feet, .. | 19 | 14 |
| | 301 | 12 |
| Establishment, at 10 per cent., .. .. .. | 30 | 3 |
| Tools and Plant, at 5 per cent., .. .. .. | 15 | 2 |
| Contingencies, .. .. .. .. | 22 | 15 |
| Total, .. | 370 | 0 |

If the cylinder is made 10 inches thick, a saving of Rs. 30 will be effected.

45. The estimated cost of the cylinder of an 8 feet tube well is given below—

| | RS. | A. |
|---|---|---|
| Curb, .. .. .. .. .. | 30 | 0 |
| Masonry cylinder, 15 inches thick, 44 feet, at Rs. 7-4-2, .. | 319 | 7 |
| Sinking, 30 feet, at Rs. 3, .. .. .. | 90 | 0 |
| Earthwork, .. .. .. .. | 15 | 0 |
| Concrete, 250 cubic feet, at Rs. 14 per 100 cubic feet, .. | 35 | 0 |
| | 489 | 7 |
| Establishment, at 10 per cent., .. .. .. | 48 | 15 |
| Tools and Plant, at 5 per cent., .. .. .. | 24 | 8 |
| Contingencies, .. .. .. .. | 27 | 2 |
| Total, .. | 590 | 0 |

By making the cylinder 12 inches thick a saving of Rs. 60 may be effected.

46. To this must be added the cost of the tube, which will vary with the kind of tubes used and the length required. It was originally intended to use " gular " wood pipes, which were obtained at Moradabad for 10 annas per foot.

For reasons given in para. 27, it is necessary to use iron pipes at Jaithra. The cheapest pipes in the market are cast-iron pipes with spigot and faucet joints, turned and bored. The prices of these pipes in Bombay, and the cost of carriage to Agra are given below—

| | RS. | A. | P. | | RS. | A. | P. | |
|---|---|---|---|---|---|---|---|---|
| 4-inch pipes cost in Bombay | 0 | 12 | 0 | per foot, and carriage to Agra is | 0 | 9 | 0 | per foot. |
| 5-inch ,, ,, | 1 | 0 | 0 | ,, ,, ,, | 0 | 12 | 0 | ,, |
| 6-inch ,, ,, | 1 | 4 | 0 | ,, ,, ,, | 0 | 15 | 0 | ,, |

To this must be added the cost of making holes, screws, &c., which will add about 8 annas per foot to the price. The cost of carriage to Jaithra is about 2 annas per foot.

Hence total cost of pipes at Jaithra will be—

| | RS. | A. | P. | |
|---|---|---|---|---|
| 4-inch pipes, .. .. .. .. | 1 | 15 | 0 | per foot. |
| 5-inch ,, .. .. .. .. | 2 | 6 | 0 | ,, |
| 6-inch ,, .. .. .. .. | 2 | 13 | 0 | ,, |

The objections to this kind of pipe are that the joints project more than an inch beyond the body of the pipe, and the turned and bored surfaces are not long enough to make the joints quite rigid.

It is probable that these pipes can be sunk to a depth of 50 or 60 feet below the bottom of the well without much difficulty. For greater depths it may be necessary to use cast-iron pipes connected by wrought-iron covering hoops.

As stated in para. 28, the 5-inch pipe is the best size for general use.

The pipe projects at least 2 feet above the concrete, and should be sunk 3 feet into the clay. Hence the length of pipe required is equal to depth of clay below bottom of well + 10 feet.

The cost of the pipe, including sinking when clay is at different depths below the bottom of well, is given below. The cost of sinking is estimated at Re. 0-8-0 per foot.

| | | | | | | | RS. | A. | P. |
|---|---|---|---|---|---|---|---|---|---|
| Clay | 10 | feet | below | bottom | of | well, cost of pipe, .. | 54 | 0 | 0 |
| „ | 20 | „ | „ | „ | „ | .. | 82 | 12 | 0 |
| „ | 30 | „ | „ | „ | „ | .. | 111 | 8 | 0 |
| „ | 40 | „ | „ | „ | „ | .. | 140 | 4 | 0 |
| „ | 50 | „ | „ | „ | „ | .. | 169 | 0 | 0 |
| „ | 70 | „ | „ | „ | „ | .. | 226 | 8 | 0 |
| „ | 100 | „ | „ | „ | „ | .. | 312 | 12 | 0 |

47. The following Table shows the total cost of a spring tube well when the "mota" is at different depths below the percolation level :—

| Depth from level of sub-soil water to the mota. | Estimated cost of Well. | |
|---|---|---|
| | 6 feet in diameter. | 8 feet in diameter. |
| | RS. RS. | RS. RS. |
| 40 | 394 to 424 | 584 to 644 |
| 50 | 423 to 453 | 613 to 673 |
| 60 | 452 to 482 | 642 to 702 |
| 70 | 480 to 510 | 670 to 730 |
| 80 | 509 to 539 | 699 to 759 |
| 100 | 567 to 597 | 757 to 817 |
| 130 | 653 to 683 | 843 to 903 |

48. *Percolation wells.*—The cylinders of these wells are made 6 feet in diameter. They will cost almost exactly the same as the cylinders of spring tube wells of the same diameter. Extra precautions must be taken in sinking them, and this will counterbalance the saving effected by not using mortar in 18 feet of their length. Hence the cost of the cylinder (12 inches thick) will be Rs. 370.

If the cylinder is surrounded by broken bricks to a thickness of 12 inches, 1,000 cubic feet of brick ballast will be required. At Jaithra this will cost very little, as there is a quantity of lime siftings and broken brick at the kiln, which is useless for any other purpose. But if a number of these wells were made, it would be necessary to burn or purchase the ballast, which would cost about Rs. 4 per 100 cubic feet. Hence cost of 1,000 cubic feet of ballast would be Rs. 40. To this must be added the cost of sinking it round the cylinder.

If the ballast sinks sufficiently by simply working the well, the expenditure will be very small. Arrangements must be made to keep the trench open and to carry the water raised from the well over the trench. The water will be raised from the well by the cultivators and will be used for irrigation. As the ballast sinks, more will be thrown into the trench. Rs. 10 should be sufficient to cover this. In this case the total expenditure on ballast and sinking will be Rs. 50.

If it is necessary to sink a pipe round the well and to ram the ballast into it while it is being withdrawn, the cost will be about Rs. 50 greater. The pump must be sunk and lowered in from 12 to 15 places round the cylinder, say 15. The cost of sinking and withdrawing the pipe once, and ramming the ballast into it, will be about Rs. 4; and for doing this 15 times the cost will be Rs. 60. Hence the total expenditure, including ballast, sinking pipe, &c., will be Rs. 100. Therefore the total cost of a percolation well is Rs. 420 to 470.

As mentioned above, the cost of the percolation wells at Jaithra will be less than this, as there is a considerable quantity of waste material at the kiln, which will be used for ballast. The percolation wells first made were 5 feet in diameter, and it was intended to make them all of this size, as it was not expected that they would give water for more than two buckets. But it appears probable that if the cylinder can be entirely surrounded by ballast, the percolation through it will be sufficient for four buckets. Some percolation wells, 6 feet in diameter, have recently been started.

49. The conditions which determine the best size of well to build are given in para. 16.

It has been estimated (para. 42) that an ordinary spring well, 8 feet in diameter, costs half as much again as a well 6 feet in diameter. The former will take twice as many buckets as the latter; hence the relative cost per bucket of the two wells is as 3 to 4. We have to consider whether the advantage in cost which the larger well possesses is neutralized by the additional loss in the channels in irrigating a larger area.

Water is lost in a watercourse in threewa ys—(i), by soakage into the soil; (ii), by evaporation from the water surface; and (iii), owing to irregularities in the bed, some water is retained in the channel after irrigation has ceased. If the channel has a good slope and is properly made (ii) and (iii) are comparatively small, and the chief loss is by percolation, which varies with the kind of soil through which the watercourse runs.

It is probable that in a given channel the loss by soakage varies nearly as the wetted surface (= wetted perimeter × length) of the channel. If the rate of discharge is doubled the wetted perimeter is increased in a much smaller proportion, and the channel may be made longer without increasing the percentage lost by percolation. Hence if all the water raised from a well is sent down one channel and into one field at a time, the proportion lost in the watercourses on an 8 feet well is probably no greater, and may even be less, than that lost on a 6 feet well.

Cultivators are well aware of the economy that results from irrigating on this system, and when the land round a well belongs to different men they frequently combine together to do so. But this cannot always be counted on, and if the irrigation of three or four fields is carried on together the loss in the channels will be increased, and the area irrigated from the 8 feet well will be less than double the area irrigable from a 6 feet well. So long as the area irrigated for bucket on the former exceeds three-fourths of that on the latter, the advantage as regards economy is still on the side of the 8 feet well.

A two-bucket well costs about Rs. 250, and the cost per bucket is about 30 per cent. greater than that of a four-bucket well.

Until a well is made the water supply obtainable from it is uncertain. It varies with the nature of the sand below the "mota," coarse sand yielding water more readily than fine sand. It also depends on the extent of the sandy stratum both horizontally and vertically.

This uncertainty about the supply is the chief objection to making large wells, as after they are made it may be found that the full number of buckets cannot be worked on them. The supply in a spring well is nearly always enough for four, but is frequently insufficient for eight small buckets. The former therefore appears the best size for general use.

Some 8 feet wells are being built in gauhan land near other wells, in which the supply has proved to be ample.

50. As regards spring tube wells. Mr. Crooke is of opinion that if he can secure a rate of profit at 6 per cent. it will pay him to make wells. Allowing, as in the last para., a profit of Rs. 24 from a 6 feet well in outlying lands, and of Rs. 48 from an 8 feet well in the gauhan and tarai, the cost of a 6 feet well must not exceed Rs. 400, and of an 8 feet well Rs. 800. The Table in para. 47 shows that, accepting these limits, a 6 feet well should not be made where the "mota" is more than 40 feet, nor an 8 feet well where the "mota" is more than 100 feet below the level of sub-soil water.

51. Next as to percolation wells. Spring tube wells 6 feet in diameter cost Rs. 394 to Rs. 424 where the "mota" is 40 feet deep, and Rs. 423 to Rs. 453 where the "mota" is 50 feet deep. If a percolation well giving enough water for four buckets in a year of drought can be made for Rs. 400, it should be made wherever the "mota" is more than 40 feet deep in preference to a spring tube well 6 feet in diameter.

52. Wells of any description can be built more cheaply in a year of drought than after a year of average rainfall. If the level of sub-soil water falls 10 feet, the saving in wells of different kinds and sizes will vary from Rs. 30 to 50.

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## VI. REPORT OF WORK DONE AND IN PROGRESS.

53. Two experimental wells were sunk at Jaithra in 1880, in sites chosen by Mr. Benson. One of them reached clay at a depth of 18 feet 6 inches. The other was sunk 15 feet 6 inches, and the divers said it was on clay, but this was afterwards found to be incorrect, and the well has been sunk 2 feet 6 inches deeper, and is now on the "mota."

54. In April 1881, a trial boring was made in a spot about three-quarters of a mile from these wells, and clay was found at a depth of 24 feet. The boring apparatus used was of the ordinary kind, consisting of iron rods screwed together, with various tools to be attached to the lowest rod. The soil being sandy, a 3-inch wrought-iron pipe was sunk to keep the bore open, and the tools worked inside the tube. The apparatus proved quite unsuitable for the sandy soil at Jaithra. Each time the tools were withdrawn from the pipe a considerable time was wasted in unscrewing the rods, and only about 1 foot in length of the auger contained sand.

The sand came into the pipe almost as quickly as it was removed. The trial boring occupied three weeks, and cost Rs. 26 in labor alone.

55. The two experimental wells made in 1880 are percolation wells, the greater part of the steining below the water surface being made of bricks laid dry. This description of well cannot be sunk into or through clay without great difficulty. Clay having been found within 24 feet of the percolation level in the three places where trials had been made, the wells, which were then started, were made of bricks laid in mortar. Before the end of October, 18 wells had been built and four of them had been sunk 30 feet without reaching clay. Since then the remaining 14 wells have been sunk, but only six of them have reached clay.

56. The variation in the depth to the clay in different parts of the village rendered it necessary to make a more extensive series of trial borings before building any more wells. Some new tools and pipes were ordered in November 1881. They were received in March, but some alterations were required, and these were not completed till May.

In the meantime 20 more wells were started, the cylinders being built to a height of only 5 feet pending the results of the trial borings. A reference to *Figs.* 3 to 6, *Plate Nos.* IV. and V., will show that up to this height the steining of a spring and percolation well is built in exactly the same way, but above 5 feet the bricks in the former are laid in mortar, while in the latter they are laid dry.

Bricks were also carried to the sites of 16 wells, and 7 of these have since been started.

57. The new boring apparatus is made on the system which has been found to work satisfactorily at Moradabad in sinking the wooden tubes through sand. For working in

wet sand a sludge pump is used, very similar in construction to that of a common suction pump. It consists of a cylinder with a valve at the bottom opening upwards. A piston with a valve in it, also opening upwards, moves up and down inside the cylinder, and a rope is attached to the end of the piston rod. The piston is made sufficiently heavy to sink by its own weight. When the piston is raised the foot valve of the cylinder opens, and sand and water are drawn into the cylinder. When the piston descends the foot valve closes, so that the sand cannot escape, while the valve in the piston opens, allowing the water to pass out. The piston is raised and lowered three or four times, in order to fill the pump with sand; the pump is then withdrawn and the sand cleared out. If the soil is hard it is first broken by means of a heavy jumper attached to the rope, and the *débris* is removed by the sludge pump. This system of boring has been used by Messrs. Mather and Platt, of Manchester, in sinking artesian wells to depths of over 1,500 feet, and the deep boring at Umballa was made with their apparatus. It is especially useful for boring in wet sand, as the sludge pump is filled very quickly and removed at once by means of the rope, the heavy iron rods being entirely dispensed with. Two pumps should be used, one being worked while the other is being cleaned. As far as I have seen at present the system does not appear very suitable for getting through soft plastic clay, as the jumper works it up into "puddle," which cannot be removed by the sand pump. But if coarse sand is thrown down the bore before the jumper is worked, the clay is mixed with the sand, and lumps of the mixture are drawn into the pump.

58. In May, immediately after the receipt of the new tools, borings were made in two of the wells that had been sunk without reaching clay. In one well (in Jaithra) the mota was reached at a depth of 60 feet below the percolation level. In the second well (in Khiria Lagar Sahai) the pipes were sunk 75 feet without reaching clay, and as their total length is only 75 feet 6 inches, they could not go any deeper. They were therefore withdrawn.

59. Since then borings have been made in the 20 wells that were built 5 feet high and in nine more sites. The object being to ascertain whether a spring or a percolation well should be made, only 40 feet of tubing are used.* If the pipes reach clay they are sunk into it until no sand is brought up in the sludge pump, and the jumper is then worked until it has penetrated 2 or 3 feet of the clay. If the clay prove to be thicker than this the pipes are withdrawn. If no clay is found, or only a thin stratum which cannot form an efficient "mota," the pipes are sunk 39 feet and then withdrawn.

In 22 out of the 29 borings clay has been reached within 25 feet from the percolation level, and at an average depth of 21 feet 3 inches. In the remaining seven the pipes were sunk to an average depth of 39 feet 1 inch below the percolation level without finding clay. Most of this work has been done since the rains commenced, and the percolation level has risen. The depth, therefore, from the normal percolation level to the clay is less than that given.

The 29 borings have cost Rs. 76 for labor alone, or Rs. 2-10 per boring. To this must be added the cost of ropes and an allowance for the wear and tear of tools and pipes. This should not exceed Rs. 2, making the total cost of a boring less than Rs. 5.

60. The result of the trial borings has been to show that in a great part of the tract where kucha percolation wells are now made by the cultivators a stratum of "mota" exists at a depth very favorable for the construction of masonry spring wells. This is shown in *Plate No.* II. Up to the present "mota" has not been found in Khiria Lagar Sahai and Mahaya. It is found on the west side of Tigra Bhamora, and in about half of the land of Jaithra which is debarred from canal irrigation. In Bahgon it is found on both sides of the tract in which spring wells are made by the villagers. Borings are still in progress, and the map will require modification when their results are known.

It is interesting to note that the "mota" has been found either within 25 feet from

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* *Vide* para. 51.

the percolation level, or not within 40 feet from it. It would appear, therefore, that the stratum which exists under a great part of the percolation well tract terminates abruptly. The sections obtained in three wells at *p*, *q* and *r*, are given in *Figs.* 9 to 11, *Plate No.* V. The distance from *p* to *r* is only 2½ furlongs, but the three sections differ very much.

Since the borings have been made, work has been started again on the 20 wells that were built to a height of 5 feet, and 7 more wells have been started. Seven of these will be percolation wells, and the cylinders of twenty will reach clay.

61. Some new tools and pipes have been obtained for making deep borings in the 12 wells which have been sunk. One set of pipes, 120 feet long and 3-inch bore, was supplied by the Superintendent of the Canal Foundry, Roorkee; the other, 150 feet long and 2-inch bore, by Messrs. T. E. Thomson and Co. of Calcutta. The pipes are connected by outside screwed couplings, rounded or bevelled, in order to reduce the resistance as much as possible. With each set of pipes three steel shoes have been supplied, so that six smaller sets can be made up, each long enough to ascertain if the "mota" is less than 40 feet from the percolation level or not. The sand pumps have been made by Messrs. Coen and Co. of Agra.

Borings were commenced with these pipes early this month. The 3-inch pipes were put down one of the old wells in Jaithra, and reached clay at a depth of 55 feet below the percolation level. It was intended to ascertain the thickness of the "mota" by putting an Abyssinian tube well, 1¼-inch in diameter, down the 3-inch pipe and trying to drive it through the clay. But before the 3-inch pipes were properly bedded in the clay, a jumper got jammed in the lowest pipe, and as the rope broke it was necessary to withdraw the pipes.

They were then put down the well in Khiria Lagar Sahai, in which the old pipes had been sunk to a depth of 75 feet without finding clay. They have been sunk 80 feet below the percolation level and are still in sand.

The 2-inch pipes have been put down a well in J thra near the boundary of Khiria Lagar Sahai, and have been sunk 83 feet below the per ation level without reaching clay.

Thin seams of soft white clay have been passed through in all the deeper borings that have been made, but they offer little resistance to the passage of the tubes, and would certainly not form a good "mota." Strata of sand kankar and of nodular kankar have also been passed through. When the 2-inch pipes were sunk 45 feet below the percolation level, they went through a stratum of kankar, which was so compact that all the water was pumped out of the pipe without drawing any sand into it. If the kankar has a sufficient area to allow the cavity mentioned in para. 24 to form below it, a good supply of water should be obtained. The sinking of the pipes has been continued below this stratum in order to ascertain the depth to the clay.

62. The present state of the work is as follows:—18 wells have been built and sunk, and six have reached clay. Two of the latter are in Jaithra and have been completed, the "mota" having been pierced; they are 6 feet in diameter. The remaining four are in Bahgon, and are 5 feet in diameter. They would have been finished before this but the gang of divers who sank them proved quite useless as soon as the wells reached clay, though they sank them through the sand without difficulty. The divers at Khwájapur will shortly have finished their work and will be sent to Bahgon.

Of the 12 wells that are in sand, five are 5 feet and seven are 6 feet in diameter. Borings have been made in three of the latter, and in two of them clay has been reached within 60 feet from the percolation level, while in the third the pipes have been sunk 80 feet without reaching clay. A pipe has been sunk 83 feet in one of the 5 feet wells without finding clay.

Judging from the positions of the wells, it is probable that clay will be found within 60 feet in five out of the seven 6 feet wells; but no idea can yet be formed of its depth in two of the 6 feet wells and in the five 5 feet wells. Owing to the clay stratum being so much deeper than was anticipated, the cost of these wells will be greater than was esti-

mated, but will be advisable to sink iron pipes 5 inches in diameter in all of the 6 feet wells. Pipes have been ordered for the two wells in which clay has been found.

As regards the 5 feet wells, only two buckets can work in them, and it is not worth while to spend much money on them. Unless clay or a compact layer of kankar is found within 20 or 30 feet from the bottom of a 5 feet well, an attempt will be made to get the water by percolation, and it is possible that sufficient water to supply two buckets can be obtained in this way.

63. The cylinders of 27 wells are being built, and 8 of them have been partially sunk. 20 cylinders will reach clay; 7 will be sunk 30 feet in sand, and will obtain their water by percolation. They cannot be sunk until the masonry is set.

64. Bricks have been carried to the sites of 12 more wells, and as soon as trial borings have been made the wells will be started. Until the tube and percolation wells that have been commenced have been finished and tested, it is proposed to confine the work to places where ordinary spring wells can be made.

The financial year of the Awa Estate closed at the end of last month, but the accounts have not yet been made up.

# KHWAJAPUR CIRCLE.

## I. DESCRIPTION OF THE WELLS NOW USED.

65. The villages of the Khwájapur Circle are shown in *Plate No.* III. As previously stated, they are situated between the Sirsa and Domaria Nadis. The soil is generally light *píliya* or *bhúr*. A line of sand-hills runs through the villages, and much of the land is undulating. There is very little *usar*.

66. Among the sources of irrigation are the Patna jhil and the Sirsa nadi. Khwájapur is situated on the western border of the Patna jhil, and contains some of its tarai. About 200 acres of the village are assessed as irrigated from the jhil.

Shamspur is bounded on the south-west by the Sirsa nadi. There is some tarai in the village, and 13 acres are assessed as irrigated from the nadi.

67. Some irrigation is done from two distributaries of the Ganges Canal. The Harduaganj Distributary passes through a corner of Chirgawan, and tails into the Sirsa nadi above Shamspur. It irrigates a few fields in both of these villages.

The Lodhipur Distributary passes to the east of the villages, and irrigates a few acres in Khwájapur. A great part of the land in the Circle is too high to get irrigation from these rajbahas.

68. Wells form the main source of irrigation in all the villages; in Ataullahpur, Muhabatpur and Pasyapur Begampur they are the only source. The depth from the surface of the ground to the level of sub-soil water varies from 15 to 30 feet. The water is generally sweet, but there are some brackish wells in Chirgawan.

A few of the wells receive their supply by side percolation, but most of them reach the "mota," and are supplied by springs.

The cost of a kucha well is stated by the villagers to be from Rs. 10 to Rs. 12, but from enquiries that have been made the actual cost to the cultivators appears to be about Rs. 6.

The kucha wells last two years at the furthest; most of them fall in the year they are dug.

None of them give water for more than one bucket, and in some wells the supply is not enough for this.

69. All the wells are worked on the *kili* system, two pairs of bullocks being employed to one bucket. The rope is attached to a loop on the yoke by means of a wooden pin (*kil*). When the bullocks get to the bottom of the run, the driver removes the pin and walks up the run holding the end of the rope. On reaching the top he finds a second pair of bullocks waiting there, and attaches the rope to their yoke. By the time the second pair of bullocks have got to the bottom of the run, the first pair have reached the top and are ready to go down again.

The buckets are large, containing from 26 to 36 gallons. The cattle are stronger than those used in the eastern part of the Etah District.

70. The following Table, taken from the Settlement papers, gives the areas of irrigated and dry land in six of the villages:—

108322

| Name of Village. | Area of | | Total cultivated area. | Total area. |
|---|---|---|---|---|
| | Irrigated land. | Dry land. | | |
| | acres. | acres. | acres. | acres. |
| Ataullahpur, .. .. .. | 125 | 67 | 192 | 210 |
| Chirgawan, .. .. .. | 1,022 | 183 | 1,205 | 1,297 |
| Pasiyapur Begampur, .. .. | 251 | 130 | 381 | 451 |
| Shamspur, .. .. .. | 440 | 594 | 1,034 | 1,285 |
| Khwájapur, .. .. .. | 507 | 134 | 641 | 764 |
| Zainpura, .. .. .. | 260 | 285 | 545 | 604 |
| | 2,605 | 1,393 | 3,998 | 4,611 |

Rather more than a third of the cultivated land was assessed as dry.

In his note on Zainpura, Mr. MacConaghey states that "this estate is capable of much improvement if more cultivators were located and a few pucka wells sunk." The same may be said of other villages—especially Shamspur and Ataullahpur.

## II. THE AREA IRRIGABLE FROM A WELL.

71. Table III. gives the area irrigated during the last rabi from some spring wells in the Khwájapur Circle. The average area irrigated per bucket was 7·57 acres from pucka and 5·85 acres from kucha wells, the average for the whole being 6·15 acres.

The villagers say that a pair of bullocks can irrigate 25 kucha bigahs, or nearly 5 acres of rabi crops. Hence one bucket worked by two pairs of bullocks should irrigate nearly 10 acres. Doubtless this area can be irrigated if the well is constantly worked, but the greatest area recorded on a single bucket well is 8·8 acres.

The average area irrigated from nine single-bucket pucka wells was 8·11 acres, and from three two-bucket wells it was 6·75 acres per bucket.

8·5 acres appears a fair estimate of the area that can be irrigated from a single-bucket well in the rabi season, and a two-bucket well should irrigate 7·5 acres per bucket, or 15 acres altogether.

72. The arguments used in paras. 14 to 16 when discussing the area irrigable from a well at Jaithra apply equally to the Khwájapur villages. A 6 feet well can take two large buckets, and should irrigate 15 acres of land in the rabi season. The total area irrigable from a well of this size is 15 acres if the well is situated in gauhan or tarai land, and 30 acres if it is in the barha.

In outlying lands the two-bucket well seems the best size to build, but in the gauhan and tarai lands a four-bucket well, 8 feet in diameter, will prove the most economical, provided the spring is powerful enough to supply it.

73. It is interesting to note the difference between the area irrigable from a 6 feet well at Jaithra and from a well of the same size at Khwájapur.

At Jaithra the *nágaur* system of working is adopted. The cattle and buckets are small. Four buckets can be worked in a 6 feet well. One bucket irrigates 3 acres of rabi crops, and the well can irrigate 12 acres in a season.

At Khwájapur the *kíli* system prevails. The cattle are stronger and the buckets very large. Only two buckets can be worked in a 6 feet well, but one bucket worked by two pairs of bullocks can irrigate 7½ acres in the rabi season. 15 acres can be irrigated from the well, or 25 per cent. more than can be irrigated from a well of the same size at Jaithra.

## III. THE COST OF IRRIGATION.

74. The actual cost to the cultivators of making a kucha well is about Rs. 6. The area irrigated by a well in the rabi is rather less than 6 acres (Table III). Most of the wells last only one year. Hence the cost of the well is about Re. 1 per acre irrigated. In gauhan and tarai lands the cost is Re. 1 per annum; in outlying lands it is 8 annas per annum.

In order to obtain a fair rate of profit from masonry wells, an enhancement equal to double these rates must be levied on the irrigable area. · Therefore if pucka wells are built in places where kucha wells can be made, the cultivators must pay for the indirect advantages that will accrue from the wells, in addition to the direct gain they will receive by being saved the cost of making the kucha wells (para. 18).

Many of the sites chosen are in places where kucha wells are not made, and then the question to be settled is simply the difference between the value of "wet" and "dry" land.

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## IV. THE CONSTRUCTION OF MASONRY WELLS.

75. The "mota" appears to be very generally found in sinking wells in the Khwájapur villages, and it is probable that no percolation wells will be required. Most of the wells will be ordinary spring wells (*Fig.* 3, *Plate No.* IV.), but in some places the "mota" may prove sufficiently thick to require a small shaft being sunk into it (*Fig.* 4, *Plate No.* IV.) A few tube wells (*Fig.* 5, *Plate No.* IV.) may also be required.

76. The principles that regulate the construction of spring wells have already been discussed. One point, however, which has been mentioned in para. 35, threatens to assume more importance at Khwájapur than it does at Jaithra. Where the strata permit it the cisterns should be 25 feet deep. But if the bottom of the "mota" is less than 30 feet below the percolation level, the depth of the cistern must be reduced. It is necessary to fix the minimum depth of cistern that may be allowed.

As mentioned in para. 35 a great deal of uncertainty exists as to the depth the water will fall in a year of drought, and also as to the fall when the well is worked. By sinking the cylinder 25 feet below the ordinary percolation level, we allow for a fall of 21 feet when the well is worked during a dry year. If the cylinder is sunk only 15 feet, the water cannot fall more than 11 feet altogether, and this is the least amount of fall that should be counted on in a two-bucket well. Therefore no 6 feet wells should be built in places where the bottom of the "mota" is less than 20 feet below the percolation level. If any masonry wells are made in such places they should be 3 feet 6 inches or 4 feet in diameter, suitable for only one bucket.

No 8 feet wells should be built in places where the bottom of the "mota" is less than 30 feet below the percolation level, as the fall of water when four buckets are worked will be greater than when only two are employed.

I may mention that an experiment was started at Jaithra to determine the connexion between the discharge from a well and the fall of the water surface, but it was stopped by the early rain. The experiment will be made during the cold weather.

77. No borings have yet been made in these villages. The tools used at Jaithra are designed to work in sandy soil, and if the pipes are not stopped by kankar, lelwa, or clay, they are often sunk 25 feet in a day. But when the pipes reach clay the progress is very slow.

An Abyssinian tube well, with the driving apparatus used by the Royal Engineers, has been obtained from the Canal Foundry, Roorkee, but it has not yet been tried. It is probable that this tube, or a modification of it, will prove very useful for testing clay soils.

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## V. THE COST OF MASONRY WELLS.

78. In estimating the cost of the wells at Jaithra, the average length of the cylinder

above the percolation level has been assumed to be 14 feet. At Khwájapur it will be about 24 feet, or 10 feet longer.

If the cylinders are sunk to the same depth, the cost of the wells at Khwájapur may be found by adding to the estimated cost of the wells at Jaithra the cost of the additional 10 feet of masonry and of the extra earthwork required.

If the cylinder is 6 feet in diameter and 12 inches thick, the cost of 10 feet in length is—

| | RS. |
|---|---|
| 10 × Rs. 4-6-6 = .. .. .. .. | 44 |
| Add for earthwork, establishment, &c., .. .. | 16 |
| Total Rs., .. | 60 |

By making the cylinder 10 inches thick, the cost will be reduced to Rs. 50.

If the cylinder is 8 feet in diameter and 15 inches thick, the cost of 10 feet in length will be—

| | RS. |
|---|---|
| 10 × Rs. 7-4-2 = .. .. .. .. | 73 |
| Add for earthwork, establishment, &c., .. .. | 22 |
| Total Rs., .. | 95 |

If the steining is made 12 inches thick, the cost will be reduced to Rs. 80.

79. Adding these amounts to the figures given in para. 42, we obtain the following results :—

A 6 feet well costs from Rs. 390 to Rs. 425 according as the cylinder is 10 or 12 inches thick.

An 8 feet well costs from Rs. 585 to Rs. 650 according as the cylinder is 12 or 15 inches thick.

As in the case of the Jaithra wells, the cost of an 8 feet well is about half as much again as the cost of a 6 feet well.

80. A 6 feet well in the barha can irrigate 30 acres, and if the enhancement is fixed at Re. 1 per acre, an annual profit of Rs. 30 will be obtained from the well. If the well costs Rs. 425, the rate of profit will be 7 per cent.

An 8 feet well in gauhan land irrigates 30 acres, and if the enhancement on the land is fixed at Rs. 2 per acre, an annual profit of Rs. 60 will be obtained. If the well costs Rs. 655, the rate of profit will be 9·2 per cent.

81. The cost of a spring tube well may be found by adding the cost of the extra 10 feet of the cylinder to the figures given in para. 47.

If the minimun rate of profit is fixed at 6 per cent., the cost of a 6 feet well must not exceed Rs. 500, and of an 8 feet well Rs. 1,000.

## VI. REPORT OF WORK DONE AND IN PROGRESS.

82. Two 6 feet wells have been completed. One of them was sunk 22 feet and the other 17 feet when the "mota" was pierced. There are about 4 feet of clay below the curbs.

Two 6 feet wells have been partially sunk. One cylinder, 7 feet 6 inches in diameter and 12 inches thick, has been built to a height of 30 feet, but has not been sunk. Six curbs of this size have been made, but the cylinders are hardly large enough for four large buckets, so the curbs are now being made 8 feet in diameter.

Twenty-five wells have been dug to the percolation level, and all of them would have been started had not the brick-burning failed. Two contractors agreed to supply 5,00,000

bricks before the 31st May, at Rs. 12 per 1,000 for first class, and Rs. 8 per 1,000 for second class bricks. For bricks supplied after this date, the rates were to be reduced by Re. 1 per 1,000 for each class of bricks. Not more than 25 per cent. of the total bricks supplied were to be second class. The mean dimensions of the bricks is 12″ × 6″ × 3″. The contractors moulded 5,00,000 and burnt 3,00,000, but by far the greater number of the latter have turned out *pila*, and out of the bricks intended for 6 feet cylinders, only enough to build four wells were obtained. Most of these are second class, and the wells have therefore been plastered inside.

Arrangements have been made to burn the bricks in Bull's kiln by petty contract and daily labor, and some wood on the canal has been purchased for the purpose. As soon as the bricks are ready more wells will be commenced.

W. J. WILSON,

*14th October, 1882.* ***Assistant Engineer on Special Duty.***

TABLE I.—*Showing area irrigated from Spring Wells in some villages of the Jaithra Circle, Awa Estate, Fasl Rabi,* 1881-82.

| DESCRIPTION OF WELL. | | | | | | | AVERAGE AREA IRRIGATED | |
|---|---|---|---|---|---|---|---|---|
| Pucka or Kucha. | Number of buckets worked on each well. | Depth from ground to water in well. | Name of village. | Number of wells | Number of buckets. | Area irrigated in acres. | By one well. | By one bucket. |
| | | Feet. | | | | | | |
| Pucka, .. | 4 | 11 and 17 | Bahgon, .. | 2 | 8 | 14·35 | 7·18 | 1·79 |
| ,, .. | 4 | 12 | Jaithra, .. | 1 | 4 | 5·29 | 5·29 | 1·32 |
| | | | | 3 | 12 | 19·64 | 6·55 | 1·64 |
| ,, .. | 2 | 7 and 17 | Bahgon, .. | 5 | 10 | 18·93 | 3·78 | 1·89 |
| | | Total | Pucka wells, .. | .. | 22 | 38·57 | .. | 1·75 |
| Kucha, .. | 2 | 10 and 14 | Bahgon, .. | 14 | 28 | 72·07 | 5·15 | 2·57 |
| ,, .. | 1 | 10 and 11 | Bahgon, .. | 11 | 11 | 31·24 | 2·84 | 2·84 |
| ,, .. | 1 | 12 | Jaithra, .. | 1 | 1 | 1·94 | 1·94 | 1·94 |
| | | | | 12 | 12 | 33·18 | 2·77 | 2·77 |
| | | Total | Kucha wells, .. | .. | 40 | 105·25 | .. | 2·63 |
| | | | Grand Total, .. | .. | 62 | 143·82 | .. | 2·32 |

TABLE II.—*Showing area irrigated from Percolation Wells in some villages of the Jaithra Circle, Awa Estate, Fasl Rabi,* 1881-82.

| DESCRIPTION OF WELL. | | | | | | | AVERAGE AREA IRRIGATED | |
|---|---|---|---|---|---|---|---|---|
| Pucka or Kucha. | Number of buckets worked on each well. | Depth from ground to water in well. | Name of village. | Number of wells. | Number of buckets. | Area irrigated in acres. | By one well. | By one bucket. |
| | | Feet. | | | | | | |
| Pucka, .. | 2 | 10 and 15 | Jaithra, .. | 3 | 6 | 16·15 | 5·38 | 2·69 |
| ,, .. | 1 | 9 and 11 | ,, | 15 | 15 | 54·10 | 3·61 | 3·61 |
| ,, .. | 1 | 13 | Khiria Lagar Sahai, | 1 | 1 | 1·23 | 1·23 | 1·23 |
| | | | | 16 | 16 | 55·33 | 3·46 | 3·46 |
| | | | Total Pucka wells, .. | .. | 22 | 71·48 | .. | 3·24 |
| Kucha, .. | 2 | 13 | Jaithra, .. | 1 | 2 | 2·05 | 2·05 | 1·02 |
| ,, .. | 2 | 11 | Mahaya, .. | 1 | 2 | 4·76 | 4·76 | 2·38 |
| ,, .. | 2 | 10 and 12 | Khiria Lagar Sahai, | 4 | 8 | 13·98 | 3·49 | 1·75 |
| ,, .. | 2 | 13 | Tigra Bhamora, .. | 2 | 4 | 15·15 | 7·57 | 3·79 |
| | | | | 8 | 16 | 35·94 | 4·49 | 2·24 |
| Kucha, .. | 1 | 1 and 18 | Jaithra, .. | 216 | 216 | 600·79 | 2·78 | 2·78 |
| ,, .. | 1 | 10 and 18 | Khiria Lagar Sahai, | 36 | 36 | 82·92 | 2·30 | 2·30 |
| ,, .. | 1 | 10 and 11 | Mahaya, .. | 16 | 16 | 54·19 | 3·38 | 3·38 |
| ,, .. | 1 | 9 and 11 | Bahgon, .. | 36 | 36 | 116·26 | 3·23 | 3·23 |
| ,, .. | 1 | 10 and 11 | Tigra Bhamora, .. | 14 | 14 | 42·48 | 3·03 | 3·03 |
| | | | | 318 | 318 | 896·64 | 2·82 | 2·82 |
| | | | Total Kucha wells, .. | .. | 334 | 932·58 | .. | 2·79 |
| | | | Grand Total, .. | .. | 356 | 1,004·06 | .. | 2·82 |

TABLE III.—*Showing area irrigated from Spring Wells in some villages of the Khwájapur Circle, Awa Estate Fasl Rabi* 1881-82.

| DESCRIPTION OF WELL. | | | Name of Village. | Number of wells. | Number of buckets. | Area irrigated in areas. | AVERAGE AREA IRRIGATED | |
|---|---|---|---|---|---|---|---|---|
| Pucka or Kucha. | Number of buckets worked on each well. | Depth from ground to water in well. | | | | | By one well. | By one bucket. |
| | | Feet. | | | | | | |
| Pucka, .. | 2 | 24 | Begampur, .. | 1 | 2 | 13·30 | 13·30 | 6·65 |
| ,, .. | 2 | 28 | Pasyapur, .. | 1 | 2 | 14·38 | 14·38 | 7·19 |
| ,, .. | 2 | 15 | Khwájapur, .. | 1 | 2 | 12·81 | 12·81 | 6·40 |
| | | | | 3 | 6 | 40·49 | 13·50 | 6·75 |
| ,, .. | 1 | 18 | Rámpura, .. | 1 | 1 | 8·25 | 8·25 | 8·25 |
| ,, .. | 1 | 12 and 16 | Khwájapur, .. | 4 | 4 | 32·92 | 8·23 | 8·23 |
| ,, .. | 1 | 31 | Zainpura, .. | 1 | 1 | 8·80 | 8·80 | 8·80 |
| ,, .. | 1 | 20 and 22 | Chirgawan, .. | 2 | 2 | 16·18 | 8·09 | 8·09 |
| ,, .. | 1 | 21 | Faridpur, .. | 1 | 1 | 6·86 | 6·86 | 6·86 |
| | | | | 9 | 9 | 73·00 | 8·11 | 8·11 |
| | | Total Pucka wells, .. | | 12 | 15 | 113·50 | .. | 7·57 |
| Kucha, .. | 1 | 16 and 20 | Rámpura, .. | 5 | 5 | 34·57 | 6·91 | 6·91 |
| ,, .. | 1 | 18 and 27 | Ataullahpur, .. | 6 | 6 | 31·89 | 5·31 | 5·31 |
| ,, .. | 1 | 18 | Pasyapur, .. | 1 | 1 | 5·12 | 5·12 | 5·12 |
| ,, .. | 1 | 9 and 16 | Khwájapur, .. | 8 | 8 | 67·90 | 8·49 | 8·49 |
| ,, .. | 1 | 15 and 24 | Chirgawan, .. | 21 | 21 | 107·13 | 5·10 | 5·10 |
| ,, .. | 1 | 13 and 22 | Zainpura, .. | 16 | 16 | 95·88 | 5·97 | 5·97 |
| ,, .. | 1 | 18 and 28 | Faridpur, . | 15 | 15 | 78·68 | 5·24 | 5·24 |
| | | | Total Kucha wells, .. | 72 | 72 | 421·17 | 5·85 | 5·85 |
| | | | Grand Total, .. | .. | 87 | 534·67 | .. | 6·15 |

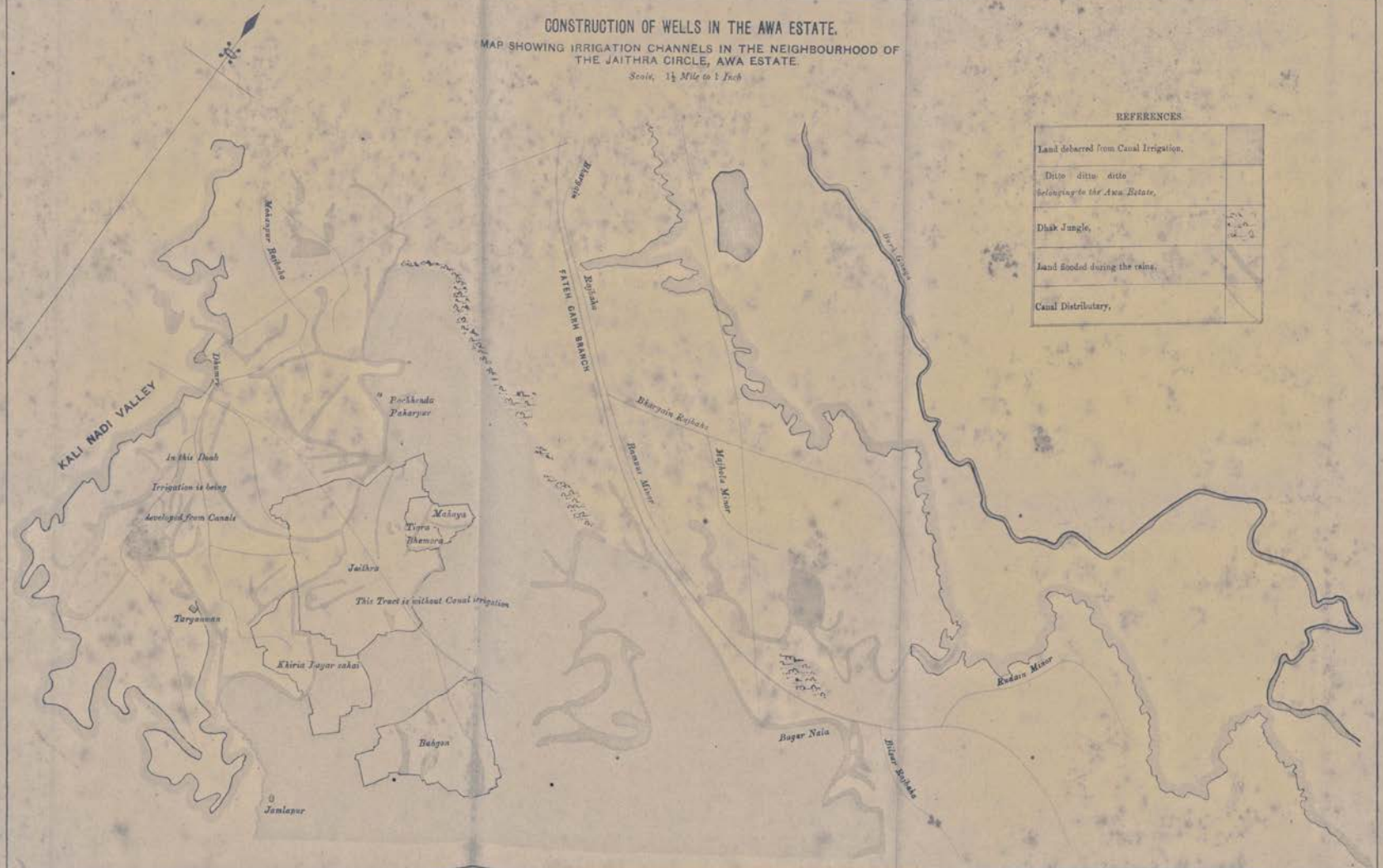
TABLE IV.—*Showing the loss of head in pipes of different diameters.*

| Diameter of pipe in inches. | Velocity of water in feet per second. | Head due to velocity = $h$. | Loss of head at the two ends of the pipe = 1·5 $h$. | Value of $c$ for incrusted pipes. | LOSS OF HEAD DUE TO FRICTION IN | | | TOTAL LOSS OF HEAD IN | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | 1 foot of pipe. | 50 feet of pipe. | 100 feet of pipe. | 50 feet of pipe. | 100 feet of pipe. |
| Discharge = 900 cubic feet per hour = 0·25 cubic foot per second. | | | | | | | | | |
| 3 | 5·10 | 0·40 | 0·61 | 0·0133 | 0·0857 | 4·29 | 8·57 | 4·90 | 9·18 |
| 4 | 2·87 | 0·13 | 0·19 | 0·0125 | 0·0191 | 0·96 | 1·91 | 1·15 | 2·10 |
| 5 | 1·84 | 0·05 | 0·08 | 0·0120 | 0·0060 | 0·30 | 0·60 | 0·38 | 0·68 |
| 6 | 1·28 | 0·025 | 0·04 | 0·0117 | 0·0024 | 0·12 | 0·24 | 0·16 | 0·28 |
| 12 | 0·32 | 0·002 | 0·002 | 0·0108 | 0·00007 | 0·004 | 0·007 | 0·006 | 0·009 |
| Discharge = 1,200 cubic feet per hour = 0·33 cubic foot per second. | | | | | | | | | |
| 3 | 6·79 | 0·716 | 1·07 | 0·0133 | 0·1528 | 7·64 | 15·28 | 8·71 | 16·35 |
| 4 | 3·82 | 0·227 | 0·34 | 0·0125 | 0·0340 | 1·70 | 3·40 | 2·04 | 3·74 |
| 5 | 2·44 | 0·093 | 0·14 | 0·0120 | 0·0106 | 0·53 | 1·06 | 0·67 | 1·20 |
| 6 | 1·70 | 0·044 | 0·066 | 0·0117 | 0·0042 | 0·21 | 0·42 | 0·28 | 0·49 |
| 12 | 0·42 | 0·003 | 0·005 | 0·0108 | 0·00012 | 0·006 | 0·012 | 0·011 | 0·017 |
| Discharge = 1,800 cubic feet per hour = 0·5 cubic foot per second. | | | | | | | | | |
| 3 | 10·19 | 1·61 | 2·44 | 0·0133 | 0·3428 | 17·14 | 34·28 | 19·58 | 36·72 |
| 4 | 5·73 | 0·51 | 0·77 | 0·0125 | 0·0765 | 3·83 | 7·65 | 4·60 | 8·42 |
| 5 | 3·67 | 0·21 | 0·31 | 0·0120 | 0·0240 | 1·20 | 2·40 | 1·51 | 2·71 |
| 6 | 2·55 | 0·10 | 0·15 | 0·0117 | 0·0094 | 0·47 | 0·94 | 0·62 | 1·09 |
| 12 | 0·64 | 0·006 | 0·009 | 0·0108 | 0·00027 | 0·014 | 0·027 | 0·023 | 0·036 |

# CONSTRUCTION OF WELLS IN THE AWA ESTATE.

## MAP SHOWING IRRIGATION CHANNELS IN THE NEIGHBOURHOOD OF THE JAITHRA CIRCLE, AWA ESTATE.

*Scale, 1½ Mile to 1 Inch*

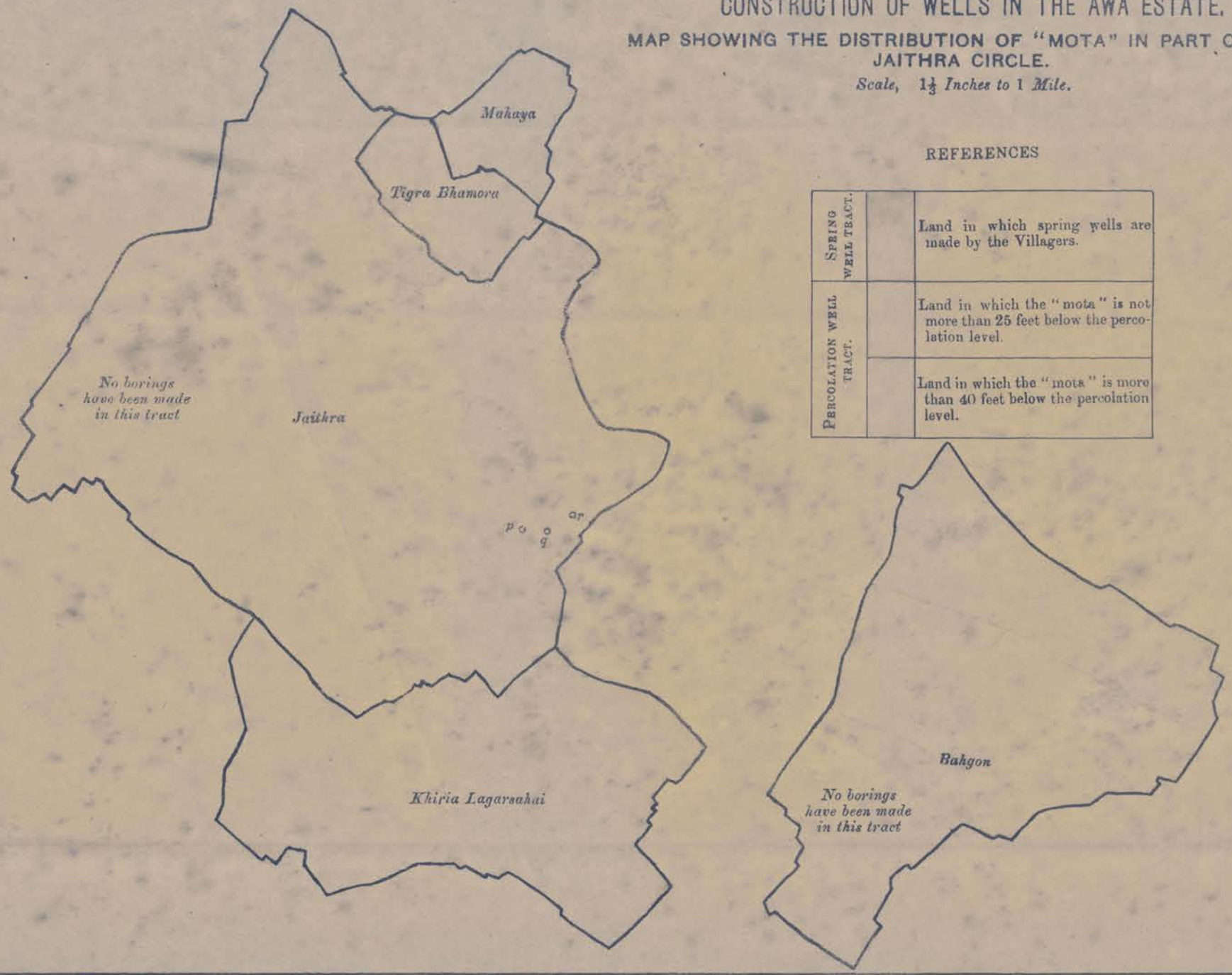


Litho. T. C. Press, Roorkee.

# CONSTRUCTION OF WELLS IN THE AWA ESTATE.

## MAP SHOWING THE DISTRIBUTION OF "MOTA" IN PART OF THE JAITHRA CIRCLE.

*Scale, 1⅓ Inches to 1 Mile.*




REFERENCES

| | | |
|---|---|---|
| Spring well tract. | | Land in which spring wells are made by the Villagers. |
| Percolation well tract. | | Land in which the "mota" is not more than 25 feet below the percolation level. |
| | | Land in which the "mota" is more than 40 feet below the percolation level. |

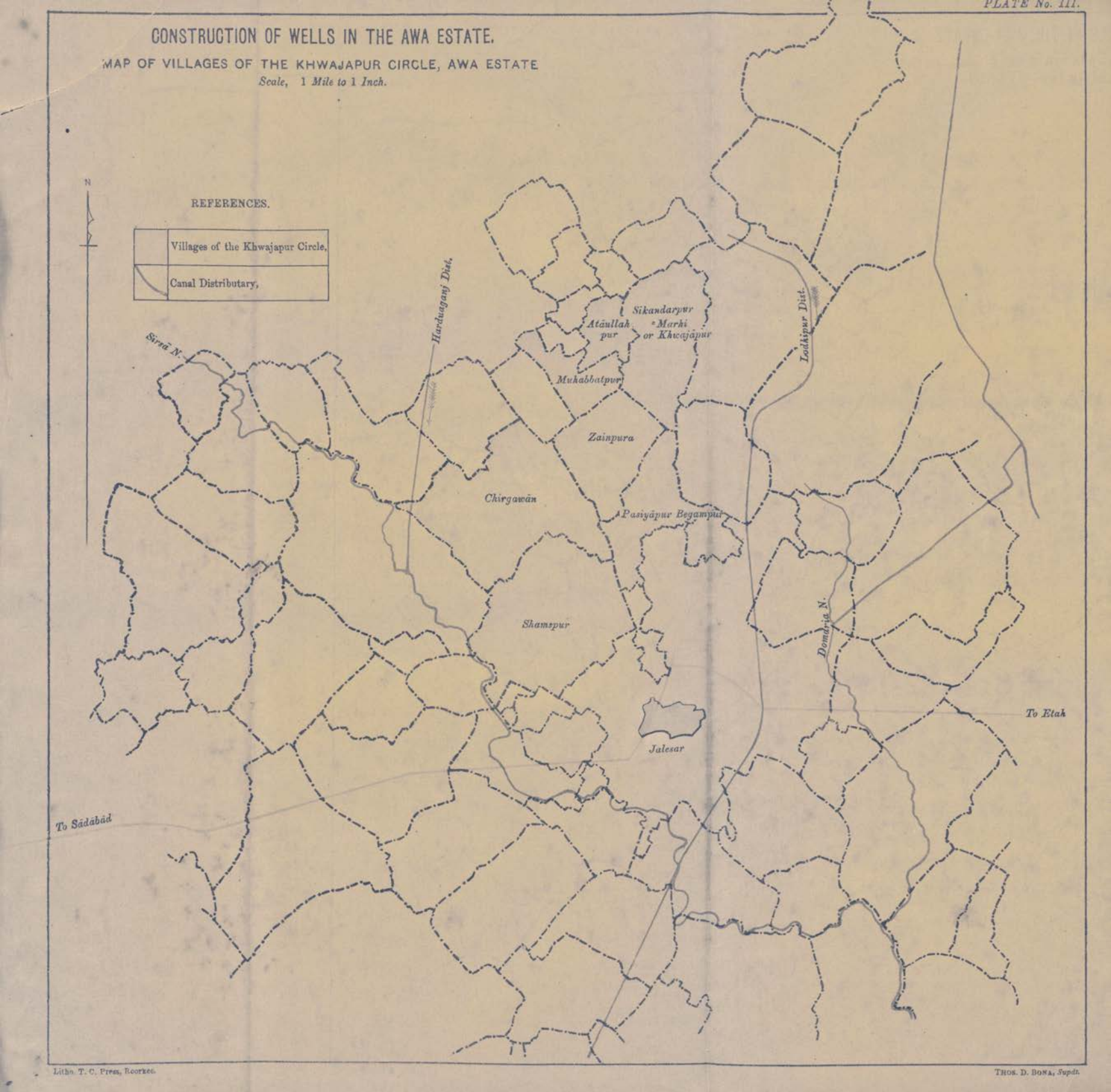
Thos. D Rona, Supdt.

PLATE No. II.

# CONSTRUCTION OF WELLS IN THE AWA ESTATE.

## MAP OF VILLAGES OF THE KHWAJAPUR CIRCLE, AWA ESTATE

*Scale, 1 Mile to 1 Inch.*

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THOS. D. BONA, Supdt.

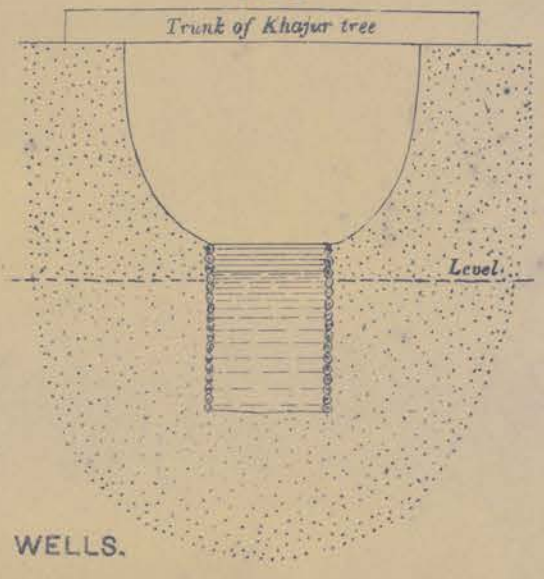
# CONSTRUCTION OF WELLS IN THE AWA ESTATE.

*Scale, 12 feet to 1 Inch.*

## SECTIONS OF KUCHA PERCOLATION WELLS.

FIG. 1.

FIG. 2




## SECTIONS OF SPRING WELLS.

MASONRY.

FIG. 3.

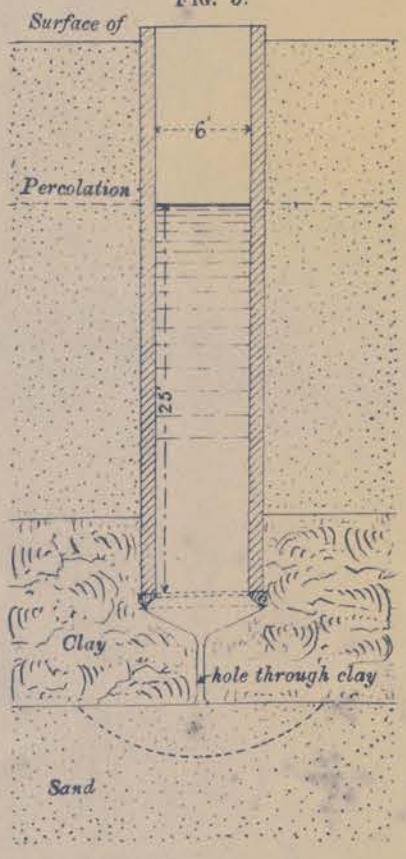



FIG. 4.

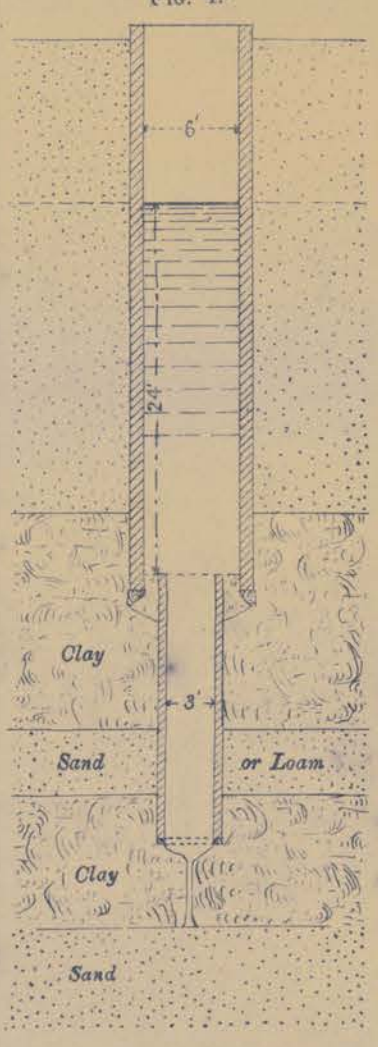
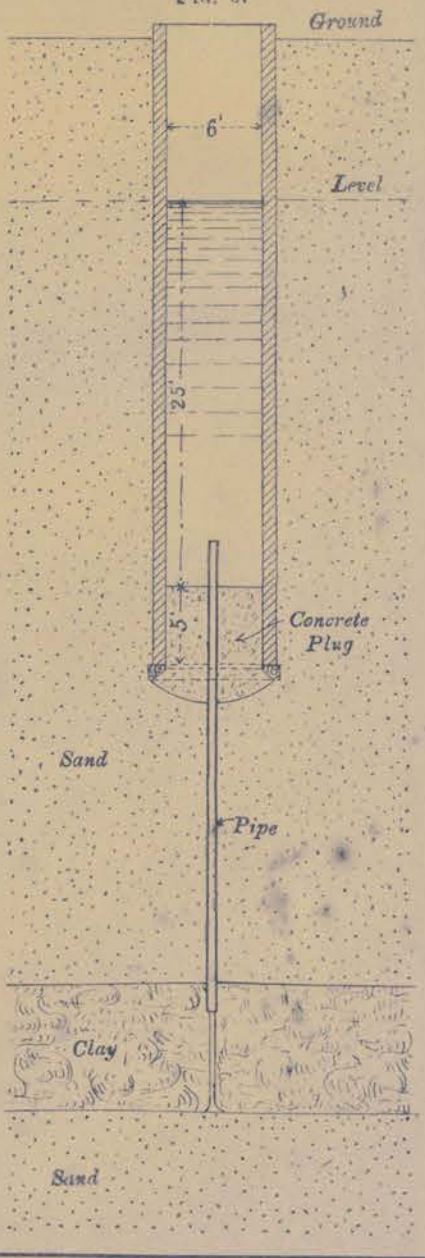



FIG. 5.




### REFERENCES.

Sand.

Water

Concrete,

Clay,

THOS. D. BORA, Supdt.

Litho. T. C. Press, Roorkee.

# CONSTRUCTION OF WELLS IN THE AWA ESTATE.

## SECTION OF PERCOLATION WELL.

*Scale, 15 feet to 1 Inch.*

Fig. 6.

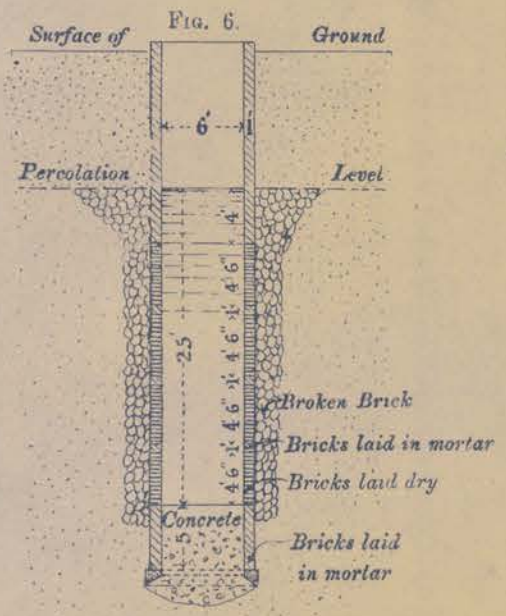



Fig. 7.

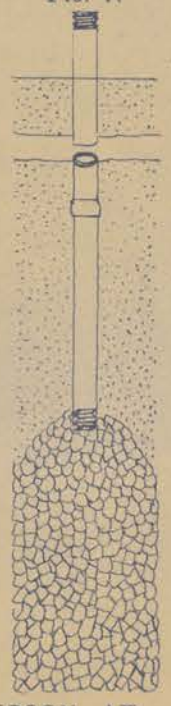
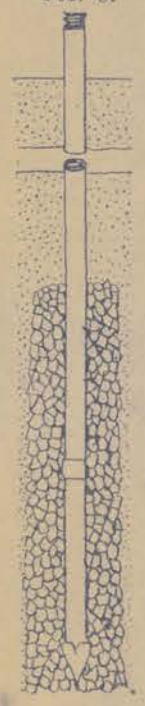


Fig. 8.



## SECTIONS OF SUBSOIL AT.

Fig. 9.
*p*

Fig. 10.
*q*

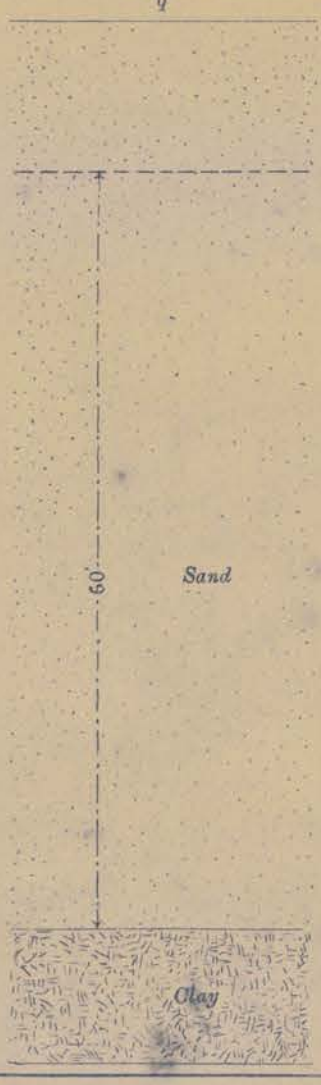
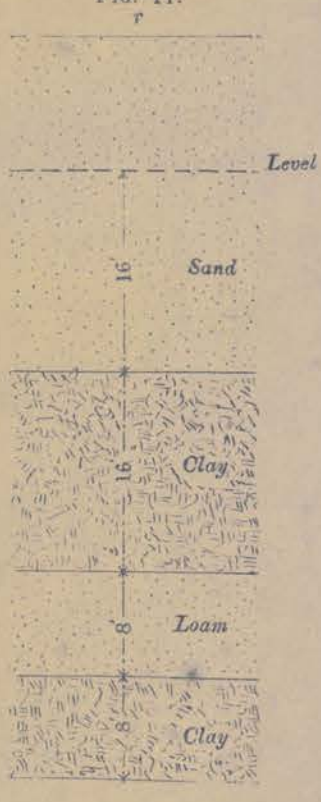



Fig. 11.
*r*




### REFERENCES.

Sand,
Water,
Concrete,
Broken Brick,
Bricks laid in mortar,
Bricks laid dry,
Clay,

Litho. T. C. Press, Roorkee.

THOS. D. BONA, Supdt.

# NOTE ON THE MORADABAD WELLS.

# NOTE

ON THE

# CONSTRUCTION OF THE MORADABAD WELLS FROM THEIR INCEPTION IN DECEMBER 1879, TO THE TRANSFER OF MR. MEARES IN AUGUST 1882.

1. On the receipt of Mr. Wright's Report on the Construction of State Wells in Cawnpore, Mr. Buck in his covering letter to Government No. $\frac{1300\ A}{ccxcxiii\ B}$ of June 19th, 1879, urged that the experiments proposed by Mr. Smeaton in the Hasanpur pargana (Moradabad) should be carried out under Mr. Alexander's supervision, and that further experiments under the same supervision should if possible be made on some adjacent tract where water was near the surface.

2. The suggestion made by Mr. Smeaton in his No. 858 of April 17th, 1879, was that a score or so of villages on the sandy plateau of Hasanpur should be provided with wells—

(1).—As a security against landlord rapacity and oppression.

(2).—As an insurance against famine. He further hoped that they might be the means of introducing a system of water-lift, which he had modified from an appliance in use in Southern and Central India. He found from actual experiment that whereas with the ordinary native lift only $1\frac{5}{8}$ of an acre had been irrigated by 16 bullocks and 12 men in 12 hours from a depth of 19 feet; with his improved lift, $2\frac{1}{2}$ acres could be watered from the same depth and the same time by 2 men and 2 buckets. The experiment was one which in itself demonstrated the necessity of making investigations which should throw more light on the elementary problems of well irrigation, as though, allowing $2\frac{1}{2}$ inches for the depth of a watering, the results of the experiment with the native *churrus* were reasonable enough; to secure the result reported by Mr. Smeaton for his lift would require that each bullock should lift 8·3 foot tons per minute, or ·56 horse-power, which is altogether incredible.

3. On November 10th, 1879, the Director of Agriculture was authorized by telegram from the Board of Revenue to settle details with Mr. Alexander, the Settlement Officer of Moradabad, and in a communication dated two days later, Mr. Buck reported to the Board that he had met Mr. Alexander, who would undertake the work in combination with Mr. Mills, an engineer of the Department of Public Works. In this letter, Mr. Buck asks for instructions as to whether he is to continue to exercise supervision over the work, and makes a suggestion, the full value of which seems at that time hardly to have been appreciated, *i. e.*, that some attempt should be made to get boring tools which would show whether or no wells could be constructed.

4. On December 9th, 1879, Mr. Mills joined at Moradabad, and a few days later Mr. Alexander reported that the work of collecting materials had commenced. Rods, augers, pipes and a crab-winch were provided from Roorkee for boring operations.

5. The nature of the objects to be aimed at was described in some detail in Mr. Buck's letter of December 12th, 1879.

The object of Government (he says) is to ascertain how in each locality wells can be most conveniently constructed, and what arrangements between cultivators and zemindars are most suitable. What is desired is that these experiments should enable Government to frame a scheme for general adoption. The special points on which information is wanted are—

(1).—What rental return actually is obtained for the advantage of well irrigation.

(2).—What area is irrigable from each well.

(3).—What increase of revenue can be expected at next settlement, and on what terms should the assessment be made.

6. Details of construction were to be settled in consultation with the Engineer, and it was important to extend the experiments to tracts where water was nearer the surface than it was at Hasanpur. In a subsequent letter (January 3rd, 1880) Mr. Buck insists that, as the experiments are not local but provincial, more than one kind of well shall be constructed. The Engineer should have full latitude to construct any kind of well that had a *primâ facie* prospect of success. He again hopes that a tract may be found where water is much nearer the surface than at Hasanpur, and where cultivators, while willing to use them, are unable to construct permanent wells.

7. Mr. Alexander on his part made a number of suggestions, the most important of which are found in his letter to Mr. Buck of January 13th, 1880. He there proposes to build 50 (presumably) four bucket wells at an estimated cost of Rs. 650 each, allowing nothing for cost of supervision. These wells were to be distributed into the following classes:—

(*a*).—Twenty wells—the zemindars were to buy them outright by payment of the cost of construction in a lump sum or by instalments, interest at 6 per cent. being charged on outstanding balances.

(*b*).—Fourteen wells—the zemindars were to manage these and pay interest only on the cost of construction, with option of purchase at any time. In this case the interest was to be 8 per cent. payable for a minimum period of 20 years.

(*c*).—Eight wells. Government was to have the management, and the zemindars to guarantee Government a certain income as long as the wells were kept in working order. The income in this case was to be 5 per cent. on the cost of construction, and as Government being the manager, would take all the increased rents secured by the wells, the zemindars would only be called on to pay the guarantee in the event of the wells proving a financial failure, a result of which there appears to have been no presentiment.

(*d*).—Eight wells were to be built as a pure speculation and without any guarantee. The two latter suggestions appear to be explained by a passage in a previous communication, in which Mr. Alexander proposed that a certain number of wells was to be built for cultivators, and crop rates, analogous to those charged for canal water, collected by the Tahsildar. There is no suggestion as to how Government was to acquire the land. He urges that unless a large number is constructed the experiment will be inconclusive, and adds: the main object will be gained if a certain tract is protected from famine and actual loss avoided, and that an all round return of 5 per cent. would be very satisfactory.

8. Throughout the earlier stages of this experiment three entirely different and not easily reconcilable views of what was to be its aim seem to have held the ascendancy in turns.

(1).—The wells were to protect this particular tract from famine.

(2).—They were to be made as a commercial speculation.

(3).—They were to enable Government to ascertain by actual experiment on what terms and under what conditions it could build wells all over the Provinces.

9. Mr. Buck applied for a grant of Rs. 25,000 for the Hasanpur wells, and Rs. 5,000 for the wells which were to be constructed in a tract of high water level, and the Board

sanctioned Rs. 15,000 to be spent during the current year, instructing Mr. Buck to furnish an estimate of what would be required in the ensuing year for inclusion in their budget. They further directed that the rate of interest chargeable to zemindars should be 6½ per cent. This ruling was subsequently modified by Government, which authorized Mr. Alexander to charge at his discretion any rate between 4½ and 6¼ per cent., provided that arrangements were made for the recovery of the principal within 20 years. In a letter dealing with this point Mr. Buck remarks that 5 per cent. will be too low a rate to charge for interest, as Government will undertake repairs.

10. On January 30th, 1880, Mr. Alexander was authorized by Mr. Buck to construct 25 wells in any case, and 25 more if they did not interfere with his project of building experimental wells on the tracts of high water level; and the experiment was thus commenced—in the joint charge of Messrs. Alexander and Mills, and under the general supervision of Mr. Buck.

11. The money advanced was placed, by the order of Government, at the credit of Mr. Alexander at the Moradabad treasury, and not at the credit of the supervising department. The Accountant General was directed to pass disbursements on the Settlement Officer's order.

12. Mr. Mills was in charge of the engineering part of the work for about five months. He fell ill, and went on leave some time in May 1880. The exact date of his giving over charge has never been ascertained. Of what was done during that period there is no very clear record, but I can say from what I learnt when at Amroha in October last, that there had been considerable activity in the direction of engineering experiment. The first difficulty to be encountered was one which has not even yet been overcome, and which while it has been fatal to the financial success of the undertaking, gives it its whole value as a pure experiment. It was found that, while the water level was very much higher than appears to have been anticipated, in fact so near the surface of the ground, that any experiments with wells at higher water levels were quite superfluous, in the great majority of cases no clay could be reached except at enormous distances, if at all, and it became abundantly evident that to construct a remunerative well on the ordinary principles was a sheer impossibility. It then occurred to Mr. Mills that an effective well might be constructed by sinking a masonry cylinder in the sand to such a depth as to allow for the free play of the bucket in periods of maximum exhaustion, and that the supply of water might be obtained through a tube sunk from the bottom of the well till it reached and pierced the clay stratum. To test these views a tube was sunk in an old and exhausted well belonging to Ghulam Chisti Khán, at Hasanpur, to a depth of 77 feet below the ground and 44 feet below the percolation level. At that depth it tapped the clay, and as an immediate result the well, which had hitherto been nearly empty, received a copious supply of water. Success seemed assured, and the only problem left to solve was the proper diameter of the tube, and the cheapest and most durable material. It was not till nearly two years later, in October 1881, that the experiment was discovered to be inconclusive.

13. As iron was too dear to be used with any prospect that a well built with it would pay interest on cost of construction, experiments were made with other materials. Segmental bricks, or clay tubes sunk inside an iron tube, which was afterwards to be withdrawn, were tried without success. Proposals were made to fill the iron pipe with coarse sand and then withdraw it, or to sink a very thin and inexpensive iron pipe and leave it in the well, with a clay pipe inside to strengthen it. Eventually it was determined to adopt a suggestion made by Mir Muhammad Muhsin Khán, the very intelligent zemindar of Amroha, to sink pipes of gular wood, which he bored at his own house by a very ingenious machine invented for the purpose by himself.

14. There is no clear record of the amount of work done during the five months when Mr. Mills was in charge. It appears that a large supply of bricks had been burned, a few borings been made, and, as mentioned above, the tube sunk in Ghulam Chisti's old well, and a considerable number of experiments made with different kinds of tubing.

15. On Mr. Mill's departure Mr. Alexander was left in sole charge without any professional assistance, except that of a native Sub-Overseer on Rs. 25 per mensem, of whom

it was subsequently reported that he was old and inefficient, and had never done anything but desk work.

16. On May 25th, 1880, Mr. Alexander reported further difficulties on his side of the undertaking. The zemindars in many cases had stubbornly refused to enter into any engagements for the repayment of the money to be spent, and were willing if not anxious to see their tenants ruined. He made two new proposals. Either the cost of the wells should be made repayable in 12 yearly instalments, and made an addition to the revenue at which they had recently been assessed, or the zemindars should be compelled to collect crop rates from the tenants benefited by the wells, and receive a small percentage for their trouble. Mr. Wright, who then officiated as Director, forwarded the proposals with the remark that both at Cawnpore and in Moradabad zemindars showed an unconquerable objection to the construction of wells by the State, and a recommendation that compulsory measures should be resorted to. The Board, however, negatived both Mr. Alexander's proposals, and directed that where the zemindars agreed, bonds should be taken, and where not, the cases should be reported. They had already demanded Mr. Alexander's final Report and the Director's review of it.

17. The first regular Progress Report was sent in by Mr. Alexander on August 24th, 1880, and the state of the undertaking at that time was as follows:—Fifty wells had been projected—29 in Hasanpur—18 in Amroha, and 3 in Sambhal—of these one, the old well in Hasanpur Khas, of which mention has been made, had been completed; in two other old wells a tube had been sunk to nearly a sufficient depth; a fourth old well had been sunk to 18 feet beyond its original depth. Of the remainder, 15 or 16 feet of masonry had been built and sunk in three; the same height of masonry had been built but not sunk in 13; in 23 the bricks and curb were ready, the pits dug for most of them, and in some building commenced, in others delayed for want of lime. For three, the curb only had been made; for one other, the curb was being made: of three, those in charge of the zemindar of Keshopur Bhindi, no details are given. The arrangements with zemindars were not fully completed, and are more fully reported in Mr. Alexander's next detailed communication.

18. In the same month Government gave the important ruling that the Engineer's pay was not to be charged to the Government advance for wells. A small sum, the exact amount of which was left to the Settlement Officer's discretion, was to be added on this account to the money repayable by the zemindars, as otherwise the real cost of construction would not be known, and one of the principal aims of the experiment would be defeated.

19. Mr. Alexander, with his assistant Mr. Darrah, had been in the constant habit all through the hot weather and rains, of driving to the well tract, the nearest point of which was 25 miles from the station, whenever a Sunday or holiday released them from the pressure of their regular work. But the wells themselves were scattered over a very large area, the best supervision a civilian could give would be little better than futile, and in answer to Mr. Alexander's urgent appeals Captain Bellasis was appointed, and took over charge of the engineering part of the work on December 25th, 1880.

20. On the first day of 1881, Mr. Carmichael visited Rajabpur, Hasanpur and Amroha, and inspected the wells which were in course of construction in that neighbourhood. He found that the question of material for tubing was still undecided. Iron, earthenware, and gular wood were all being tried at the same time in different wells. Natives were watching the experiment with interest, and Mr. Carmichael had no doubt that a large number of applications for wells would be the result if it succeeded. Mr. Carmichael indicated as the weak points of the experiment that Mr. Alexander had been under the mistaken impression that he was justified in resorting to compulsion, and that the wells were scattered over far too wide an area.

21. In connexion with this visit, Mr. Alexander drew up a second Progress Report explaining his action, and again commenting on the hostility of the zemindars, which he attributed mainly to what was no doubt one of the chief causes, the commutation of their tenants' rents from grain to cash payments, which was then in progress under his orders.

22. The arrangements for repayment of the money which was to be spent were as follows:—

(*a*).—For seventeen wells, Mir Muhammad Muhsin Khán engaged to pay the cost estimated after completion, provided that it did not amount to more than Rs. 400 per well, with 5 per cent. on outstanding balances within 12 years. Interest to run from the date of the bond.

(*b*).—Bonds had been taken from Ghulam Chisti Khán for nine wells. The period in this case was 10 years for three wells and 12 for the remainder, and there was a slight difference in the method of calculating the principal sum.

(*c*).—In eight cases bonds were taken from the neighbouring cultivators who used the wells. They were to repay the consolidated principal and interest in 20 years by annual instalments.

(*d*).—In three cases annual water rates were accepted by the neighbouring cultivators.

(*e*).—The actual money advanced to the zemindar of Keshopur Bhindi was to be recovered in 15 years. Interest at 5 per cent. and the principal being consolidated. Government incurred no responsibility for the construction.

(*f*).—Four were Government property or in Court of Wards, and for one it had been found impossible to come to terms with any of the inhabitants, and Mr. Alexander eventually paid its cost out of his own pocket.

23. At this time the distinction is at first clearly drawn between the (about) 25 which were being constructed by contractors under direct supervision, and the 20 which were being made under the superintendence of the zemindars. The latter were the 17 undertaken by Mir Muhammad Muhsin Khán, and the three in Sambhal.

24. The Progress Report up to the time when Captain Bellasis took over charge shows the following results of the first year's operations on the wells under direct Government supervision:—

(*a*).—Completed with tube—one. This was the old Hasanpur well.

(*b*).—Cylinder completed and tube partly sunk—one.

(*c*).—Cylinder completely built and sunk but no tube—four.

(*d*).—Cylinder partly built and sunk—fourteen.

(*e*).—Bricks collected—four.

(*f*).—To be abandoned—one.

25. During the cold weather of 1881 Mr. Alexander, who may be regarded as the originator of the experiment, and who had been in charge since its initiation, went on leave. Captain Bellasis also left the work after he had been in charge for nearly four months, and the prosecution of the experiment was left to Mr. Meares, the Executive Engineer of Moradabad, who took over charge from Captain Bellasis on April 17th, 1881.

26. His first action was to send in a Progress Report which showed the following results for the wells under direct supervision.

(*a*).—Completely finished—one at Hasanpur.

(*b*).—Cylinder finished and tube sunk to what might be a sufficient depth—three.

(*c*).—Cylinder finished and pipe partly sunk—two.

(*d*).—Cylinder finished but no pipe—nine.

(*e*).—Cylinder partly built and sunk—seven.

(*f*)—Cylinder partly built but not sunk—two.

(*g*).—No work done—four.

This list includes two wells which are not found in Mr. Alexander's Progress Report. They never advanced beyond the stage of collecting a few bricks.

27. Mr. Meares retained sole charge of these wells till September 27th, 1881. When on his representation that his ordinary district duties interfered with their proper supervision, Mr. Sub-Conductor Edwards was sent to take over the work under Mr. Meares' orders.

28. During the last fortnight in October 1881 I inspected as many wells as were sufficiently advanced to admit of being tested in the company of Mr. Wilson, the Departmental Engineer.

The work up to that date had accomplished the following result :—

(*a*).—Reported as completely finished—twelve.

(*b*).—Cylinder finished and clay pipe sunk and broken off—one.

(*c*).—Masonry finished and only tube wanting—four.

(*d*).—Masonry partly built up and sunk—six.

(*e*).—Pit only dug—two.

(*f*).—Not commenced—two.

29. The wells reported as finished were tested by Mr. Wilson and myself by the simultaneous use for about 1½ to 2 hours in each case of a bucket holding about 25 gallons, and a Cawnpore farm pump. The amount of water drawn was about 500 cubic feet in the hour, and in only one case did any well show signs of exhaustion. As far as the water supply went the result was perfectly satisfactory, and showed the possibility of irrigating the area estimated by Mr. Alexander, *i.e.*, between 20 and 30 acres for a two bucket, and between 40 and 50 for a four bucket well.

30. Three only of the wells had reached the clay stratum. One of these had not been sunk to a sufficient depth to provide a sufficient supply of water.

The other two not only supplied ample water, but were perfectly free from any invasion of sand. They were absolute successes.

31. But in the remaining eight, which may be taken as typical of the wells over the whole tract, a defect was disclosed which does not appear to have been anticipated, and which, unless remedied, would prove fatal to their utility. The cylinders rested on sand, which, when the water was drawn, rushed in, and filled them up to a depth which ranged from 2 feet 6 inches in a well which was only tested for nineteen minutes, to as much as from 4 feet 8 inches to 8 feet 3 inches in those which had been tested for longer periods. It was not clearly ascertained how much of this sand came up through the pipe, but it was plain that the greater part, if not all of it, came from under the curb, and that the work of only a few days would leave the cylinders suspended over a vacuum in which they must very soon be engulfed.

32. The first step necessary was therefore to plug up the bottom of the wells in such a manner as to exclude the sand. When that had been done, it remained to be seen whether the pipe itself would not bring up sand enough to endanger eventually the safety of the wells. Mr. Meares, who accompanied us for the greater part of the time in which we were engaged on the testings, thought that a plug of kunkur in layers of graduated sizes might act as an effectual sieve, admitting water but excluding the sand. This experiment was sanctioned, and on December 18th, 1881, at the suggestion of Captain Clibborn, I directed that the further experiment should be tried in one well at least of plugging it with an impermeable layer of concrete, thereby leaving the whole of the feeding to be done by the tube. The tubing then being used was the gular wood pipe made by Muhammad Muhsin Khán, and of 5-inch diameter. It appears to answer well, but it remains to be seen how it will stand the test of time.

33. In December 1881, Mr. Meares reported that he was not satisfied with the work done by Mr. Sub-Conductor Edwards, and suggested that he should be sent to his ordinary duties, Mr. Meares being relieved of his district duties and put in exclusive charge of the wells. The arrangement was sanctioned, and came into effect in the beginning of February 1882.

34. Early in February Mr. Meares reported that he was in want of funds. It was necessary to make some enquiries relative to his statement of accounts, but in the meantime

Rs. 2,000 were sanctioned by the Board of Revenue in March to prevent the work coming to a standstill.

35. On April 14th I received an order from Government directing me to close the wells by the end of that month current. I ventured to give reasons why this order should be reconsidered, and received at once assurances that this should be done; assurances which were carried into effect by Government Order 715 of May 8th, 1882. In Government Order 967 of June 7th, 1882, it was ruled that the extra expense of Rs. 600, which had been applied for by Mr. Meares might be sanctioned on the understanding that the wells should be completed for that amount. But in the meantime the Board of Revenue had forwarded the earlier order direct to the Collector of Moradabad, with instructions that all work on the wells should be closed by April 30th. The first news I received of this was by a letter from Mr. Meares informing me that he had already taken charge of district work. I at once addressed the Board, and on the urgent representations of both Mr. Tracy and Mr. Meares, it was agreed that he should retain charge of the wells as a part of his ordinary district work, an arrangement which had already been sanctioned by his Department when his connexion with them began a year before. Things remained on this footing till the middle of August, when a private communication from Mr. Meares to the effect that he had been transferred from Moradabad was again the first intimation I received that the continuity of the experiment was threatened. He left the work under orders from the Chief Engineer some time in the last week of August, and this is a convenient date to bring the history of the experiment up to.

36. It remains for me to revert to the Engineering part of the operations. Early in April, Captain Clibborn visited the wells at my request, and reported that he had tested two wells. That at Rajohan, which had reached clay, and which was the only one except the old Hasanpur well, which Mr. Wilson and I had found to be perfectly successful when we tested the wells in October, was subjected to a severe strain for nine hours and showed no signs of exhaustion or subsidence. Our conclusions were fully confirmed by this second trial, and it may be accepted as a complete success.

The second well, at Chak Dhanori, had been fitted with a ballast plug, and was, as Mr. Meares told Captain Clibborn, fairly typical of the class of wells which had been sunk. This too was severely tested for nine hours, and the result proved conclusively that the ballast plug was useless as a sieve to pass water and stop sand. The well began to crack an hour after the drawing was commenced, and in five hours had sunk 1 foot 5 inches into the ground. Before the end of the trial it was choke full of sand, and no water came in except a little through the tube, and that, it is interesting to remark, was still perfectly clear and free from sand. The whole of the sand then must have come from under the curb through the ballast plug. The cylinder had subsided, leaving the ballast plug in its old position as far higher within the cylinder as the cylinder had sunk into the ground.

Captain Clibborn further reports, that Mr. Meares found it beyond his power to bring the accounts from the beginning of the operations into an intelligible form.

37. On this report Mr. Meares was again directed to try a concrete bottom, and the Examiner of Public Works Accounts was asked to put a trained accountant at his disposal for as long as the clearing of the accounts might require him. The accountant joined Mr. Meares on May 1st, and submitted a detailed account on August 1st. I have omitted to say that in April, when the question of advancing more funds came up, I had directed Mr. Meares to abandon two wells in which only a little work had been done up to that time. The number remaining under his direct superintendence was 23.

38. On May 4th, Captain Clibborn made a second inspection of the wells, and with Mr. Meares sunk a concrete plug 4 feet thick in the bottom of the Chak Dhanori well, effectually closing all entrance either of water or sand except through the pipe. He further tested the Majhola well, in which Mr. Wilson had found that though it reached the clay, the supply of water was insufficient. Since then the bottom had been strengthened and the pipe driven further in with the effect of entirely remedying its previous shortcoming. It gave 3,600 cubic feet in $6\frac{1}{2}$ hours.

39. It took three weeks for the concrete in the Chak Dhansri well to harden, and on June 30th and 4th, four testings were made under Mr. Meares' personal supervision. The results were as follows :—

| | Time. | Water drawn. | Deduct for reduced content of well. | Delivered through tube. |
|---|---|---|---|---|
| 1st testing, .. | 1–15 | 441 c. ft. | 308 c. ft. | 133 c. ft. |
| 2nd „ .. | 2–0 | 962·5 „ | 448 „ | 514·5 „ |
| 3rd „ .. | 3–0 | 906 „ | 450 „ | 456 „ |
| 4th „ .. | 1–5 | 619 „ | 448 „ | 171 „ |

The testing, especially in the fourth experiment, when 531·5 cubic feet were drawn in 50 minutes, was much more severe than previous experiments would have justified, but the result was not discouraging. No sand came into the well, and only 2 feet 6 inches into the 80 feet of tube. Neither tube nor cylinder were in the least disturbed. The only result which was not wholly satisfactory was that the water supply had been considerably diminished. The well, which was 6 feet in diameter and was intended for two buckets, only gave a discharge of about 1,500 cubic feet in the day, which is not more than what would be taken out by a single bucket by a not very efficient cultivator.

40. On June 29th, Mr. Meares again went to the wells, and set testings going, which were continued for three days after he had returned to Moradabad. On the first day no sand came into the tube—on the second only trifling amounts. These experiments were conducted in his presence. On the fifth day (July 3rd), when he was not there, a most surprising result was reported—350 buckets, or about 1,225 cubic feet, were drawn in four hours, no sand came up while the water was being drawn, but when operations were suspended there was a sudden rush which filled up the tube and one foot of the cylinder. This extraordinary phenomenon is reported in a way which leaves much to be desired in the way of clearness, and I very much doubt whether it was correctly understood. It is possible that the fine sand suspended in the water of well left a sediment of one foot when the drawing stopped, which deceived the natives in charge of the experiment, and that the rush was merely a conjecture on their part.

41. The experiments were conducted till the 18th of July, chiefly under native supervision. The well was worked generally for four hours at a stretch, and fifty buckets (say 175 cubic feet) taken in the hour. Only a very few feet of sand came up the tube, and none into the cylinder. The result showed that, even if the report of July 3rd is to be accepted, and it is dangerous to work at the rate of 88 buckets to the hour, the well is perfectly safe with a draft of only 50 buckets to the hour, and that the limit to which it can be worked with safety is something more than 50, but less than 88, buckets to the hour.

This was the last experiment, and I have nothing further to report.

42. The position in which Government stands at this stage of the experiment is as follows :—

It has 23 wells in pargana Hasanpur, in all of which the cylinder has been fully sunk, and tube sunk to as great a distance as seems necessary. Of these

One (1) in Hasanpur has long been an established success.

One (2) in Rajohan,
One (3) in Majhola,
} have been lately proved successful.

Two { (4) Padli,
(5) Sahadra,

are reported to rest on clay and should therefore be successes, but they have not been tested.

Six { (6) Dehri Jat, No. 1,
(7) „ „ 2,
(8) Bahadurpur.
(9) Bawan Kheri, No. 1,
(10) „ „ „ 2,
(11) Rajohan, „ 2,

were tested in October 1881, and found to be unsafe. Ballast or kunkur plugs have since been sunk in all, but testing has been deferred pending the results in Chak Dhanori.

One (12) Chak Dhanori—the condition of this well has been reported in detail.

Nine { (13) Karanpur, No. 2,
(14) Ekonda, „ 1,
(15) „ „ 2,
(16) Baldana,
(17) Hashimpur,
(18) Hayatpur,
(19) Muhamdi,
(20) Manota,
(21) Rampur,

have not been tested, and it is supposed that their cylinders rest in pure sand. The pipes are reported to end in coarse sand and kunkur.

One (22) Karanpur No. 1 has not been touched since it proved a complete failure in October 1881.

One Sadhpur. I am told by Captain Clibborn that this well was tested in April by Mr. Meares, and that the cylinder has parted 22 inches below the ground surface, making the well useless. I have no official report on this, though I believe Mr. Meares mentioned the occurrence in a D. O. letter.

43. Besides there are 17 in the charge of Muhammad Muhsin Khán in Amroha. He was showing considerable activity in the construction of these up to the time of last October's testing. He then seems to have suspended operations till he saw the results of the efforts that were to be made to exclude the sand.

No report has been made relative to the three wells in Sambhal which were to have been built by the zemindar of Keshopur Bhindi.

44. On these wells bonds have been taken as described in para. 21 for the following :—

(*a*).—Hasanpur, Karanpur Nos. 1 and 2, Baldana, Hayatpur, Muhamdi, Ekonda Nos. 1 and 2, and Rampur, from Ghulam Chisti Khán.

(*b*).—Bawan Kheri Nos. 1 and 2, Chak Dhanori, Rajohan Nos. 1 and 2, Sadhpur and Padli, from the cultivators.

(*c*).—In Bahadurpur, Majhola, and Hashimpur, crop rates have been assessed on the cultivators.

(*d*).—The two wells in Dehri Jat are in the Court of Wards, and the well on Sahadra in Government property. Mr. Alexander has paid for the Manota well Rs. 369-5-0—the total cost on that having been Rs. 408-11-6.

(*e*).—A bond has been taken from the cultivators for a well in Tigaria, which has been since abandoned.

(*f*).—Bonds have been taken from Muhammad Muhsin Khán for the cost of seventeen wells, and the sum of Rs. 4,528-12-7 has already been paid on account.

(*g*).—Rs. 1,000 has been advanced to the zemindar of Keshopur Bhindi.

45. The steps remaining to be taken appear to be the following:—

(1). Careful testings should be continued at the Chak Dhanori well, and it should be ascertained how many buckets per hour can be drawn with safety. The Engineer in charge could be furnished with instructions as to how this testing might be accomplished. They are too long and too technical for this report.

(2). Most of the tubes end in nodular kunkur. The reason for this was probably the difficulty of driving a wooden tube through such a stratum. But an iron pipe could easily be put down as a continuation of the present wooden ones. It has usually been found that a layer of nodular kunkur immediately covers a layer of clay. Trial borings might be made in the tubes of the Moradabad wells by Mr. Wilson's sand pump, and if they proved that there was a clay stratum within a few feet of the end of the present pipes, the wells might probably be made perfectly efficient at a very small cost.

(3). There are reasons for believing that both the water supply might be increased and the flow of sand diminished if the hollow formed under the end of the tube were filled with bits of kunkur and hard stone. This could easily be tried. The cylinder should be emptied as far as possible, and a man sent down to drop the kunkur into the tube. He should occasionally let a line down to see that the tube was not being filled up.

(4). Wells 4 and 5 should be carefully tested. It is possible that nothing further need be done to them.

(5). The ballast or kunkur plugs should be taken out from beneath the cylinders in wells 6 to 11, and impermeable concrete plugs substituted.

(6). Wells 13 to 21 should be tested, care being taken not to subject them to such a strain as to endanger the stability of the cylinder. If, as will probably be the case, it is found that sand comes up from under the cylinder they too should be supplied with impermeable plugs.

It should be left to the Engineer in charge to say whether it would be worth while to repair the broken wells at Karanpur and Sadhpur, or whether they should be abandoned.

46. There appears to be no reason why the agreements taken for the three first wells on the list should not be enforced. In every other case they should be held liable to revision until the well has been finally pronounced on. The terms then to be exacted would depend on the safe water supply. Perhaps a capital sum calculated on the rate of Re. 1 for every cubic foot drawn during the hour would be a fair charge. That is to say, a well that would give a hundred buckets, each holding four cubic feet in the hour, would be worth Rs. 400, of course the limit originally agreed on would never be exceeded.

47. I have made no proposals as to the course to be adopted with Muhammad Mohsin Khán. That can only be determined when the experiments now in progress on the wells under direct supervision have been pushed to completion. He shared the sanguine views entertained at the commencement of the experiment, and whatever has been achieved is largely due to his energetic co-operation. He deserves I think to be treated with much consideration.

48. The statement of expenditure is taken from the accounts furnished by the accountant who was deputed to draw them up in May last. Since the commencement of the work there have been five officers in immediate charge, and four different Directors of Agriculture. This, and the fact that, owing probably to the funds having in the first instance been placed by Government at the disposal of the officer in charge, and not included in the budget of this department, no monthly audit bills have ever been furnished, has added very greatly to the difficulty of clearing up the financial aspect of the experiment. This must be my explanation of the discrepancies which occur between the cost of the finished wells which I reported in December last, and the cost of the same wells now given by the accountant.

49. The whole sum advanced by Government has been Rs. 27,600, and against this the savings up to the time when the accounts were made up appear to have been as follows:—

| | Rs. | A. | P. |
|---|---|---|---|
| Cash in Engineer's hands, ... ... ... | 53 | 15 | 4 |
| Credit at Treasuries, ... ... ... | 2,888 | 15 | 7 |
| Lapsed, ... ... ... ... ... | 2,403 | 14 | 0 |
| Total Rs., ... | 5,346 | 12 | 11 |

This would make the total expense to Government up to the same date Rs. 22,353-3-1, of which Rs. 5,528-12-7 have been advanced to Muhammad Muhsin Khân and the Zemindar of Keshopur Bhindi, leaving Rs. 16,824-6-6 as the sum spent on constructing the wells under direct supervision, on tools and plant, and on experiments. The amounts under each of these heads, as far as I can understand the accounts, have been as follows:—

| | Rs. | A. | P. |
|---|---|---|---|
| Construction, ... ... ... ... | 13,314 | 8 | 7 |
| Tools and plant, ... ... ... ... | 2,449 | 11 | 8 |
| Experiments, ... ... ... ... | 1,035 | 15 | 5 |
| Total Rs., ... | 16,800 | 3 | 8 |

Which leaves an unexplained balance of Rs. 24-2-10.

50. As has before been pointed out, it is impossible to say how much of this sum may be recoverable when the work has been completed.

51. Mr. Meares has furnished me with an account of the sums expended under the superintendence of each officer during the time he was in charge. I have not been able to make it tally exactly with the other accounts, but it seems to be approximately accurate:—

| | Work. | Tools. |
|---|---|---|
| Mr. Mills, (5 months,) ... | 5,690 13 10 | 1,271 11 4 |
| Mr. Alexander, (8 months,) ... | 5,412 4 3 | 456 3 6 |
| Capt. Bellasis, ($3\frac{1}{2}$ months,) ... | 2,426 5 0 | 187 11 3 |
| Mr. Meares, (10 months,) ... | 3,509 13 10 | 470 1 7 |
| Mr. Edwards, (4 months,) ... | 1,146 14 11 | 124 0 0 |

52. It cannot be said that the present experiments throw any light on the cost of masonry for wells, and this is so well known already that the defect is hardly a matter for serious regret. The cost of sinking tubes is less generally known, and some details which were given me by Mr. Meares in October last may be of interest. He found the cost per lineal foot to be as follows:—

| | Rs. | A. | P. |
|---|---|---|---|
| Iron tubing, ... ... ... ... ... | 2 | 0 | 7 |
| Sinking, ... ... ... ... ... | 1 | 14 | 0 |
| Total Rs., ... | 3 | 14 | 7 |
| Wood tubing, ... ... ... ... ... | 0 | 11 | 0 |
| Sinking, ... ... ... ... ... | 1 | 0 | 0 |
| Total Rs., ... | 1 | 11 | 0 |
| Earthenware tubing, ... ... ... ... | 1 | 10 | 4 |
| Sinking, ... ... ... ... ... | 3 | 0 | 8 |
| Total Rs., ... | 4 | 11 | 0 |

NAINI TAL,
*3rd October*, 1882.

(Signed) W. C. BENETT,
*Director.*

*Moradabad State Wells.*

| Number. | Site of Well. | Diameter. | Depth to water surface. | Height of cylinder. | Length of tube. | Cylinder rests on. | Pipe rests on. | Total Cost. Rs. | A. | P. | Value originally estimated. Rs. | A. | P. | Secured by | Remarks. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Karanpur I, .. | 6′ 0″ | 10′ 0″ | 38′ 7″ | 82′ 0″ | Sand | Clay | 548 | 14 | 1 | 400 | 0 | 0 | Bond, Ghulam Chisti Khán. | An old well has been built up and sunk 18 feet and pipe put in. |
| 2 | Karanpur II, .. | 8′ 0″ | 13′ 0″ | 41′ 0″ | 73′ 0″ | Sand | Sand and kunkur | 684 | 8 | 8 | 600 | 0 | 0 | ,, ,, ,, | Not tested. |
| 3 | Ekonda I, .. | 8′ 4″ | 11′ 6″ | 30′ 7″ | 8′ 0″ | Sand | Kunkur | 923 | 8 | 5 | 700 | 0 | 0 | ,, ,, ,, | Not tested—kunkur stratum probably 9″ thick. |
| 4 | Ekonda II, .. | 6′ 0″ | 10′ 0″ | 30′ 9″ | 20′ 0″ | Sand | Sand | 413 | 10 | 10 | 400 | 0 | 0 | ,, ,, ,, | Pipe in progress, May 1882—no test. |
| 5 | Sahadra, .. | 6′ 0″ | 12′ 6″ | 30′ 0″ | Nil | Clay | Nil. | 409 | 0 | 11 | 450 | 0 | 0 | Government property. | Clay bed 3 feet thick—no test. |
| 6 | Padli, .. | 6′ 0″ | 10′ 0″ | 30′ 0″ | 8′ 0″ | Sand | Clay | 407 | 11 | 0 | 450 | 0 | 0 | Bond, from cultivators. | Clay 1 foot thick—no test. |
| 7 | Hashimpur, .. | 8′ 8″ | 9′ 0″ | 30′ 0″ | 30′ 0″ | Sand | Sand and kunkur | 911 | 12 | 1 | 450 | 0 | 0 | Crop rates. | |
| 8 | Sadhpur, .. | 6′ 1″ | 11′ 8″ | 32′ 5″ | 8′ 7″ | Ballast | Sand and kunkur | 437 | 12 | 10 | 400 | 0 | 0 | Bond, from cultivators. | Wall cracked badly during last test. |
| 9 | Muhamdi, .. | 7′ 6″ | 11′ 8″ | 31′ 2″ | 27′ 7″ | Sand | Sand and kunkur | 906 | 12 | 1 | 700 | 0 | 0 | Bond, Ghulam Chisti Khán. | Tested by Engineer—sand came in. |
| 10 | Hayatpur, .. | 8′ 1½″ | 12′ 8″ | 32′ 8″ | 27′ 5″ | Sand | Sand and kunkur | 966 | 6 | 4 | 400 | 0 | 0 | ,, ,, ,, | Do. do. |
| 11 | Majhola, .. | 8′ 2″ | 12′ 0″ | 22′ 8″ | 10′ 0″ | Clay | Clay | 715 | 6 | 10 | 600 | 0 | 0 | Crop rates. | A good well. |
| 12 | Baldana, .. | 6′ 0″ | 9′ 5″ | 27′ 7″ | 30′ 0″ | Sand | Sand and kunkur | 518 | 3 | 4 | 400 | 0 | 0 | Bond, Ghulam Chisti Khán. | Not tested. |
| 13 | Chak Dhanori, | 6′ 0″ | 9′ 0″ | 30′ 0″ | 55′ 10″ | Concrete | Sand | 586 | 15 | 11 | 400 | 0 | 0 | Bond, from cultivators. | Under experiment. |
| 14 | Rajohan I, .. | 6′ 0″ | 12′ 0″ | 30′ 0″ | 4′ 0″ | Clay and ballast | Clay | 385 | 12 | 0 | 400 | 0 | 0 | ,, ,, ,, | Good well. |
| 15 | Rajohan II, .. | 6′ 0″ | 10′ 3″ | 31′ 3″ | 36′ 6″ | Ballast | Sand and kunkur | 464 | 15 | 6 | 400 | 0 | 0 | ,, ,, ,, | Tested—sand came into cylinder. |
| 16 | Bawan Kheri I, | 5′ 0″ | 10′ 0″ | 31′ 3″ | 64′ 0″ | Ballast | Sand and stone | 448 | 12 | 5 | 400 | 0 | 0 | ,, ,, ,, | Do. do. |
| 17 | Bawan Kheri II, | 5′ 0″ | 10′ 1″ | 31′ 2″ | 44′ 0″ | Ballast | Sand and kunkur | 440 | 1 | 7 | 400 | 0 | 0 | ,, ,, ,, | Do. do. |
| 18 | Bahadurpur, .. | 6′ 0″ | 10′ 4″ | 31′ 6″ | 27′ 1″ | Ballast | Sand and kunkur | 444 | 15 | 7 | 400 | 0 | 0 | Crop rates. | Do. do. |
| 19 | Dehri Jat I, .. | 6′ 0″ | 9′ 3″ | 32′ 3″ | 28′ 0″ | Ballast | Sand and kunkur | 512 | 4 | 8 | 400 | 0 | 0 | Court of Wards. | Do. do. |
| 20 | Dehri Jat II, .. | 6′ 0″ | 9′ 6″ | 31′ 0″ | 55′ 9″ | Ballast | Sand and kunkur | 477 | 8 | 4 | 400 | 0 | 0 | Court of Wards. | Do. do. |
| 21 | Rampur, .. | 8′ 2″ | 23′ 4″ | 43′ 8″ | 54′ 6″ | Sand | Sand and kunkur | 1,136 | 10 | 2 | 700 | 0 | 0 | Bond, Ghulam Chisti Khán. | Never tested—on high sandy ridge. |
| 22 | Manota, .. | 6′ 0″ | 14′ 9″ | 32′ 10″ | 16′ 4″ | Sand | Clay and kunkur | 408 | 11 | 6 | 450 | 0 | 0 | Paid by Mr. Alexander (369-5-0). | Clay stratum 9″ thick—never tested. |
| 23 | Hasanpur, .. | .. | .. | .. | .. | .. | .. | 164 | 1 | 6 | 175 | 0 | 0 | Bond, Ghulam Chisti Khán. | Old well—pipe sunk. |

# TABLES AND APPENDICES TO CAPTAIN CLIBBORN'S REPORT.

TABLE A.—*Observation and Experiment.*

STATISTICAL.

| Serial Number. | Province. | District. | Locality: Pergunna. | Locality: Village. | Year. | Area in Acres: Actual area in acres. | Area in Acres: Percentage uncultivated: Waste. | Area in Acres: Percentage uncultivated: Culturable. | Cultivated Area: Percentage of actual area cultivated. | Cultivated Area: Double cropped area in acres. | Cultivated Area: Total area actually cultivated in the year. | Percentage of Total Cultivated Area: Wet. | Percentage of Total Cultivated Area: Dry. | Kharif: Wet: Wells. | Kharif: Wet: Canals. | Kharif: Wet: Other sources. | Kharif: Dry. | Kharif: Total. | Rabi: Wet: Wells. | Rabi: Wet: Canals. | Rabi: Wet: Other sources. | Rabi: Dry. | Rabi: Total. | Irrigation Wells: Lime masonry. | Irrigation Wells: Dry bricks. | Irrigation Wells: Kacha. | Irrigation Wells: Total. | Lifts: Leather bucket. | Lifts: Earthen pots. | Lifts: Total. | Usual labor for lifting buckets. | Average area per lift, in acres: Kharif. | Average area per lift, in acres: Rabi. | Average area per lift, in acres: Total. | Remarks. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 |
| 2 | N. W. P. | CAWNPORE. | Jájmau, .. | Bidnu, .. | 1879-80 | 879·0 | 26·5 | 28·1 | 45·4 | .. | 396·0 | 34·0 | 66 0 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 9 | .. | 26 | 35 | 35 | Nil | 35 | Bullock | .. | .. | 3·5 | No. of lifts doubtful. |
| 3 | | | „ .. | „ .. | 80-81 | 879·0 | 26·5 | 36 0 | 37·5 | .. | 329·8 | 55 0 | 45·0 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 7 | 5 | 27 | 39 | 39 | .. | 39 | „ | .. | .. | 4·6 | „ „ „ |
| 5 | | | „ .. | Khirsa, .. | 79-80 | 1086·0 | 31·2 | 17·5 | 51·3 | .. | 557·1 | 30 4 | 69·6 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 63 | 63 | 63 | .. | 63 | „ | .. | .. | 2·6 | |
| 6 | | | „ .. | „ .. | 80-81 | 1086·0 | 31·2 | 23·0 | 45·8 | .. | 498·6 | 39 3 | 60·7 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 72 | 72 | 72 | .. | 72 | „ | .. | .. | 2·7 | |
| 8 | | | „ .. | Chachendi, .. | 80-81 | 4347·7 | 40·0 | 20·0 | 40·0 | Nil. | 1738·2 | 49·0 | 51·0 | 5·4 | 0·4 | .. | 39·6 | 45·4 | 27·5 | 15·5 | 0·2 | 11·4 | 54·6 | 2 *p*-19 | .. | 1 *p*-57 | .. | .. | .. | .. | „ | 0·4 | 2·2 | 2·6 | |
| 9 | | | „ .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 4 *p*- 9 | .. | 2 *p*-40 | 125 | 211 | .. | 211 | „ | .. | .. | .. | |
| 11 | | | „ .. | „ .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | |
| 12 | | | „ .. | „ .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | |
| 13 | | | „ .. | „ .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | |
| 16 | | | Ghátampur,.. | Gatchupur,.. | 79-80 | 1533·92 | 20·1 | 21·6 | 58·3 | 74 | 955·6 | 5·5 | 94·4 | 0·4 | .. | .. | 42·7 | 43·1 | 4·5 | 0·7 | .. | 51·7 | 56·9 | 4 *p*- 5<br>2 *p*- 9 | .. | .. | 14 | 38 | .. | 38 | „ | 0·1 | 1·2 | 1·3 | |
| 17 | | | „ .. | „ .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | |
| 18 | | | Bhognipur,.. | Bhognipur,.. | 79-80 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | |
| 20 | | | Akbarpur, .. | Niganjassi,.. | 80-81 | 948·3 | 49·3 | 5·8 | 44 9 | 1·5 | 427·5 | 47·2 | 52·8 | 0·8 | 16 3 | 0·5 | 23·0 | 40·6 | 0·4 | 29·0 | .. | 30·0 | 59·4 | 1 | .. | .. | 1 | 1 | .. | 1 | „ | 3·35 | 1·97 | 5·32 | |
| 21 | | | „ .. | Jalalpur, .. | 80-81 | 1615·4 | 23·9 | 20·7 | 55 4 | 58·2 | 953·0 | 47·2 | 52 8 | 0·6 | 29·6 | .. | 20·6 | 41·8 | 1·9 | 23·7 | 0·4 | 32·2 | 58 2 | 4 | .. | 1 | 5 | 11 | .. | 11 | „ | 0·5 | 1·6 | 2·1 | |
| 22 | | | „ .. | „ .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | |
| 528 | | | Bithúr, .. | Bithúr, .. | 79-80 | 2398 0 | 14·0 | 16·4 | 69 6 | 286·5 | 1955·0 | 18·0 | 82·0 | 0·5 | .. | 0·4 | 40·0 | 40·9 | 8·1 | .. | 9·0 | 42·0 | 59·1 | 1 *p*- 3<br>2 *p*- 3 | 1 *p*-10 | 1 *p*-51 | 67 | 70 | .. | 70 | „ | 0·11 | 2·27 | 2·38 | |
| 529 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 530 | | | „ .. | „ .. | 80-81 | 2398·0 | 14·3 | 15·7 | 70·0 | 143 3 | 1822·0 | 26·9 | 73·1 | 0·8 | .. | 0·4 | 41·1 | 42·3 | 11·2 | .. | 14·5 | 32·0 | 57·7 | 1 *p*- 3<br>2 *p*- 3 | 1 *p*-10 | 1 *p*-46 | 62 | 65 | .. | 65 | „ | 0·20 | 3·15 | 3·35 | In 81-82 many wells failed. |
| 24 | | | Somerpur, .. | Somerpur, .. | 79-80 | 9830·3 | 3·7 | 14·7 | 81·6 | .. | 8024·0 | 0·10 | 99 9 | ·07 | .. | .. | 52·5 | 52·57 | ·03 | .. | .. | 47·4 | 47·43 | 8 | .. | .. | 8 | 9 | .. | 9 | „ | 0·68 | 0 32 | 1·00 | |
| 25 | | | „ .. | „ .. | 80-81 | 9830·3 | 3 8 | 60·6 | 35·6 | .. | 3502·0 | 0·36 | 99·64 | 0 8 | .. | .. | 66·8 | 66 88 | ·28 | .. | .. | 32·84 | 33·12 | 8 | .. | .. | 8 | 9 | .. | 9 | „ | 0·32 | 1·12 | 1·44 | |
| 26 | N. W. P. | HAMIRPUR. | Maudha, .. | Maudha, .. | 79-80 | 6482·7 | 11·2 | 20·6 | 68·2 | .. | 4425·0 | 0·74 | 99·26 | ·02 | .. | .. | *x* | *x* | ·72 | .. | .. | *x* | *x* | 16 | .. | .. | 16 | 18 | .. | 18 | „ | 1·80 | 0·1 | 1·90 | |
| 27 | | | „ .. | „ .. | 80-81 | 6482·7 | 11·2 | 20·7 | 68·1 | .. | 4417·5 | 0·48 | 99 52 | ·10 | .. | .. | *x* | *x* | ·38 | .. | .. | *x* | *x* | 16 | .. | .. | 16 | 18 | .. | 18 | „ | 0·9 | 0·16 | 1·06 | Only 4 spring wells. |
| 29 | | | Mahoba, .. | Bugwa, .. | 79-80 | 2643·5 | 10·5 | 38·5 | 51·0 | .. | 1347·0 | 1·2 | 98 8 | 0·5 | .. | .. | 57·9 | 58·4 | 0·7 | .. | .. | 40 9 | 41·6 | 10 | .. | .. | 10 | 10 | .. | 10 | „ | 0·7 | 0·9 | 1·6 | Rock wells. |
| 30 | | | „ .. | „ .. | 80-81 | 2643·5 | 10·5 | 38 6 | 50 9 | .. | 1335 7 | 1·3 | 98·7 | 0·3 | .. | .. | 55 0 | 55 3 | 1·0 | .. | .. | 43·7 | 44·7 | 10 | .. | .. | 10 | 10 | .. | 10 | „ | 0·4 | 1·3 | 1·7 | „ „ |
| 31 | | | „ .. | Mahoba, .. | 79-80 | 3882 8 | 29·2 | 38·2 | 32 6 | .. | 1266·1 | 8 76 | 91·24 | 0 01 | 0·05 | .. | 63 64 | 63·7 | 2·7 | 5·6 | 0·4 | 27·6 | 36·3 | .. | .. | .. | 32 | 34 | .. | 34 | „ | 0·04 | 1 0 | 1·04 | Tank fed wells. |
| 32 | | | „ .. | „ .. | 80-81 | 3882·8 | 28 9 | 37 3 | 33·8 | .. | 1313·1 | 7·00 | 93·00 | 0·65 | 0·55 | .. | 64·3 | 65·5 | 5·6 | .. | 0·2 | 28 7 | 34·5 | .. | .. | .. | 32 | 34 | .. | 34 | „ | ·24 | 2·2 | 2·44 | „ „ |
| 34 | | | Panwári, .. | Kulpahár, .. | 79-80 | 12039·2 | 22·7 | 35·0 | 42·3 | .. | 5094·3 | 0·7 | 99·3 | 0·1 | .. | .. | 75·6 | 75·7 | 0·6 | .. | .. | 23·7 | 24·3 | 34 | .. | 11 | 45 | 34 | 11 | 45 | „ | 0·14 | ·75 | ·90 | „ „ |
| 35 | | | „ .. | „ .. | 80-81 | 12039·2 | 22·4 | 34 0 | 43·5 | 60·5 | 5298·8 | 0·91 | 99·09 | 0·01 | .. | .. | 67 5 | 67·5 | 0·9 | .. | .. | 31·6 | 32·5 | 34 | .. | 11 | 45 | 34 | 11 | 45 | „ | 0·02 | 1·05 | 1·07 | „ „ |

TABLE A.—*Observation and Experiment*—(Continued).

| DESCRIPTIVE. | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | *Date.* | | | | *Class.* | *Cost.* | | | | | | | *Supply.* | *Quality.* | *Substratum.* | *Cultivators on well.* | | *Labor and cost per day in annas.* | | | | | | | | |
| Serial Number. | Day. | Month. | Year. | Number of Well. | | Construction. | Fittings. | Total. | Renewal. | Lifts. | Yearly repairs. | Total. | | | | Number. | Caste. | Men, home. | Do. hired. | Rate, per day. | Cattle. | Cost for men. | Do. for cattle. | Total cost, per day. | | | |
| 37 | 38 | 39 | 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 | 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 | 61 | | | |
| 2 | 22 | 11 | 81 | 431 | Dry brick, .. | 200/- | 8/- | 208/- | .. | 5/- | 1/- | 11/- | Spring, .. | Sweet, .. | Clay, .. | 1 | Ahir, .. | 4 | .. | .. | 5 | 3·0 | 7·5 | -/10/6 | | | |
| 3 | .. | .. | .. | 587 | Kacha lined, .. | 20/- | 4/- | 24 - | 2/- | 5/- | 5/- | 12/- | Percolation, | „ .. | Sand, .. | 2 | „ .. | 3 | .. | .. | 2 | 2·0 | 3·0 | -/5/- | | | |
| 5 | .. | .. | .. | .. | „ „ .. | 15/- | 5/- | 20/- | 1/8 | 5/- | 2/- | 8/8 | „ .. | „ .. | „ .. | 1 | „ .. | 3 | .. | .. | 2 | 2·0 | 3·0 | -/5/- | | | |
| 8 | 17 | 12 | 81 | 2,848 | „ „ .. | 22/- | 8/- | 30/- | 5/- | 5/- | 4/- | 19/- | Spring, .. | „ .. | Clay, .. | 2 | Brahmin, .. | .. | 4 | .. | 4 | 6·0 | 6·0 | -/12/- | | | |
| 9 | .. | .. | .. | 2,846 | „ „ .. | 22/- | 8/- | 30/- | 5/- | 5/- | 4/- | 19/- | „ .. | „ .. | „ .. | 2 | Chamar, .. | 4 | .. | .. | 4 | 3·0 | 6·0 | -/9/- | | | |
| 11 | .. | .. | .. | 2,842 | „ „ .. | 22/- | 8/- | 30/- | 5/- | 5/- | 4/- | 19/- | „ .. | „ .. | „ .. | 2 | „ .. | .. | 4 | .. | 4 | 6·0 | 6·0 | -/12/- | | | |
| 12 | .. | .. | .. | 2,861 | „ „ .. | 22/- | 8/- | 30/- | 5/- | 5/- | 4/- | 19/- | „ .. | „ .. | „ .. | 2 | „ & Thakur, | 4 | .. | .. | 4 | 3·0 | 6·0 | -/9/- | | | |
| 13 | .. | .. | .. | 3,077 | Masonry, .. | 300/- | 12/- | 312/- | .. | 5/- | 1/- | 16/- | „ .. | „ .. | „ .. | . | Kachi, .. | 5 | .. | .. | 6 | 4·0 | 9·0 | -/13/- | | | |
| 16 | 23 | 11 | 81 | 400 | „ 2 pur, .. | 200/- | 4/- | 204/- | .. | 5/- | 1/- | 6/- | Percolation, | „ .. | Sand, .. | 1 | Kurmi, .. | 3 | .. | .. | 3 | 2·0 | 4·5 | -/6/6 | | | |
| 17 | .. | .. | .. | .. | „ 4 pur, .. | 300/- | 4/- | 304/- | .. | 5/- | 1/- | 6/- | „ | „ .. | „ | 1 | Mahajun, .. | .. | 3 | .. | 2 | 4·5 | 3·0 | -/7/6 | | | |
| 18 | 14 | 12 | 81 | 218 | Masonry, old bad, | 300/- | 2/- | 302/- | .. | 3/- | .. | 3/- | Spring, .. | „ .. | Clay, .. | 1 | Kachi, .. | 3 | .. | .. | 2 | 2·0 | 3 0 | -/5/- | | | |
| 20 | 16 | 12 | 81 | .. | „ „ .. | 200/- | 6 - | 206/- | .. | 6/- | 1/- | 7/- | „ .. | „ .. | „ | 1 | Ahir, .. | .. | 3 | 1·25 | 2 | 3·75 | 3 | -/6/9 | | | |
| 21 | .. | .. | .. | 705 | „ „ .. | 400/- | 24/- | 424/- | .. | 6/- | 1/- | 25/- | „ .. | „ .. | „ .. | x | Chamar, .. | 4 | .. | .. | 4 | 3 | 6 | -/9/- | | | |
| 22 | .. | .. | .. | .. | „ „ .. | .. | .. | .. | .. | .. | .. | .. | „ .. | „ .. | „ .. | x | „ | 4 | .. | .. | 4 | 3 | 6 | -/9/- | | | |
| 528 | 16 | 4 | 82 | 853 | Kacha, lined with wood, | 25/- | 4/- | 29/- | .. | 5/- | 1/- | 6/- | „ .. | „ .. | Clay 75, | 2 | Kachi, .. | 2 | 1 | 2·0 | 2 | 3 | 3 | -/6/- | | | |
| | | | | | | | | | | | | | | | | 1 | Herdsman, .. | | | | | | | | | | |
| 533 | 16 | 4 | 82 | 859 | „ „ .. | 25/- | 4/- | 29/- | .. | 5/- | 1/- | 6/- | „ .. | „ .. | „ | 1 | Kachi, .. | 3 | .. | .. | 2 | 2 | 3 | -/5/- | | | |
| | | | | | | | | | | | | | | | | 1 | Kurmi, .. | | | | | | | | | | |
| 24 | 26 | 11 | 81 | .. | Masonry, .. | 210/- | 4/- | 214/- | .. | 3/- | 1/- | 4/- | „ .. | „ .. | „ .. | 1 | Kachi, .. | 3 | .. | .. | 4 | 2 | 6 | -/8/ | | | |
| 26 | 27 | 11 | 81 | 3,850 | „ .. | 300/- | 6/- | 306/- | .. | 4/- | 1/- | 9/- | Percolation, | „ .. | „ .. | 3 | „ .. | 4 | .. | .. | 4 | 3 | 6 | -/9/- | | | |
| 27 | .. | .. | .. | .. | „ .. | 300/- | 3/- | 303/- | .. | 4/- | 1/- | 5/- | „ .. | „ .. | „ .. | 1 | „ .. | 3 | .. | .. | 2 | 2 | 3 | -/5/- | | | |
| 29 | 29 | 11 | 81 | 345 | „ .. | 200/- | 3/- | 203/- | .. | 4/- | 1/- | 5/- | „ .. | „ .. | Rock, .. | 2 | „ .. | 3 | .. | .. | 2 | 2 | 3 | -/5/- | | | |
| 31 | 30 | 11 | 81 | 1,446 | „ .. | 200/- | 3/- | 203/- | .. | 3/- | 1/- | 4/- | „ .. | „ .. | Gravel, .. | 1 | „ .. | 3 | .. | .. | 4 | 2 | 6 | -/8/- | | | |
| 32 | 1 | 12 | 81 | 1,650 | „ .. | 250/- | 6/- | 256/- | .. | 4/- | 1/- | 5/- | „ .. | „ .. | „ .. | 3 | „ .. | 4 | .. | .. | 4 | 2 | 6 | -/8/- | | | |
| 33 | 2 | 12 | 81 | .. | „ .. | 200/- | 3/- | 203/- | .. | 4/- | 1/- | 5/- | „ .. | „ .. | „ .. | 1 | „ .. | 3 | .. | .. | 2 | 2 | 3 | -/5/- | | | |
| 34 | 4 | 12 | 81 | 993 | „ .. | 100/- | 3/- | 103/- | .. | 3/- | 1/- | 4/- | „ .. | „ .. | „ .. | 1 | „ .. | 3 | .. | .. | 2 | 2 | 3 | -/5/- | | | |
| 35 | 4 | 12 | 81 | 3,001 | Kacha, .. | 5/- | 3/- | 8/- | old. | 3/- | 1/- | 4/- | „ .. | „ .. | „ .. | 4 | „ .. | 3 | .. | .. | 2 | 2 | 3 | -/5/- | | | |

TABLE A.—*Observation and Experiment*—(Continued).

EXPERIMENTAL.

| Serial Number. | Run. Class. | Run. Pairs of cattle to each lift. | Lift. Number. | Lift. Content in cubic feet. | Depth to Wells. Morning. | Depth to Wells. Evening. | Depth to Wells. Mean. | Soil. | COMMAND. *Kharif* 1881-82. Crop. | Watering required. | Area. | Total area reduced to one watering. | No. of days to area. | COMMAND. *Rabi* 1881-82. Crop. | Watering required. | Area. | Total area reduced to one watering. | No. of days to area. | AREA IRRIGATED TO DATE. *Kharif* 1881-82. Crop. | Watering given. | Area. | Working days to date. | Duty. Per lift. | Duty. Per pair. | *Rabi* 1881-82. Crop. | Watering given. | Area. | Working days to date. | Duty. Per lift. | Duty. Per pair. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 62 | 63 | 64 | 65 | 66 | 67 | 68 | 69 | 70 | 71 | 72 | 73 | 74 | 75 | 76 | 77 | 78 | 79 | 80 | 81 | 82 | 85 | 84 | 85 | 86 | 87 | 88 | 89 | 90 | 91 |
| 2 | Lagor, .. | 1·25 | 2 | 3·00 | .. | 42 | .. | Dumat, .. | Cotton, .. | 2 | 3·2 | 6·4 | 63 | Wheat & Barley, | 3 | 3·5 | 10·5 | 103 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| 3 | „ .. | 1 | 1 | .. | .. | 38 | .. | „ .. | „ .. | 2 | 1·6 | 3 2 | 59 | Wheat, .. | 3 | 3·3 | 9 9 | 183 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| 5 | „ .. | 1 | 1 | .. | 38 | .. | .. | „ .. | „ .. | 2 | 1·85 | 3·7 | 76 | Wheat, .. | 3 | 2·65 | 7·95 | 163 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| 8 | „ .. | 1 | 2 | .. | .. | .. | 32 | „ .. | „ .. | .. | .. | .. | .. | Wheat, Opium, | 4 | 3·85 | 15.4 | 92 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| 9 | „ .. | 1 | 2 | .. | .. | .. | 36 | „ .. | „ .. | .. | .. | .. | .. | Opium, .. Wheat & Barley, | 5 2 | 1·22 2·45 | 12 8 | 74 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| 11 | „ .. | 1 | 2 | .. | .. | .. | 37 | „ .. | „ .. | .. | .. | .. | .. | Wheat, .. | 3 | 1·00 | 3·0 | 48 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| 12 | „ | 1 | 2 | .. | .. | .. | 37 | „ .. | „ .. | .. | .. | .. | .. | Wheat, .. | 3 | 3·50 | 10·5 | 84 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| 13 | „ .. | 1 | 3 | .. | .. | .. | 35 | „ .. | „ .. | .. | .. | .. | .. | Opium, .. Wheat, .. Bajhra, .. | 6 3 2 | 2·90 2·23 3 45 | 31·00 | 78 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| 16 | „ .. | 1·5 | 1 | .. | 29 | .. | .. | Matyar, .. | „ .. | .. | .. | .. | .. | Gujai, .. | 2 | 3·1 | 6·2 | 87 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| 17 | „ .. | 1 | 1 | .. | .. | .. | 42 | „ .. | „ .. | .. | .. | .. | .. | „ .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| 18 | „ .. | 1 | 1 | 1·875 | 91 | 94 | 92·5 | Dumat, .. | „ .. | .. | .. | .. | .. | Vegetables, .. | .. | Small, | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| 20 | „ .. | 1 | 1 | 2·925 | 15 | 16 | 15·5 | „ | „ .. | .. | .. | .. | .. | Wheat, .. | 2 | 1·5 | 3·0 | 87 | .. | .. | .. | .. | .. | .. | .. | .. | Nil. | .. | .. | .. |
| 21 | „ .. | 1 | 2 | 2·6 | 16 | 23 | 19·5 | „ .. | Cotton and Indigo, | 2 | 4·0 | 8·0 | 22 | Wheat & Barley, | 2·5 | 12·2 | 30.5 | 85 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| 22 | „ .. | 1 | 2 | 2·6 | 16 | 23 | 19·5 | „ .. | „ .. | .. | .. | .. | .. | Potatoes, .. | 12 | 0·5 | | | | | | | | | Potatoes, .. | 12 | 0·5 | 24 | 0·250 | 0·250 |
| 528 | „ .. | 1 | 1 | 2·64 | 47 | 50 | 48·5 | „ .. | „ .. | .. | .. | .. | .. | Tobacco, .. | 12 | 1·0 | | | | | | | | | Tobacco, .. | 12 | 1·0 | 60 | 0·200 | 0·200 |
| | | | | | | | | | | | | | | Garden, .. | 10 | 1·6 | 40 | 224 | .. | .. | .. | .. | .. | .. | Garden, .. | 8 | 1·6 | 56 | 0·228 | 0·228 |
| | | | | | | | | | | | | | | Wheat, .. | 4 | 1·5 | | | | | | | | | Wheat, .. | 4 | 1·5 | 24 | 0·250 | 0·250 |
| 533 | „ .. | 1 | 1 | 2 59 | 48 | 57 | 52·5 | „ .. | „ .. | .. | .. | .. | .. | Tobacco, .. | 12 | 1·7 | | | | | | | | | Tobacco, .. | 10 | 1·7 | 65 | 0·261 | 0·261 |
| | | | | | | | | | | | | | | Potatoes, .. | 12 | 1·7 | 40·8 | 216 | .. | .. | .. | .. | .. | .. | Potatoes, .. | 12 | 1·7 | 78 | 0·261 | 0·261 |
| 24 | „ .. | 2 | 1 | .. | .. | .. | 35 | Parwa, .. | „ .. | .. | .. | .. | .. | Opium, .. | 5 | 2·0 | 10·0 | 320 | .. | .. | .. | .. | .. | .. | Paleo, .. | 1 | 0·2 | 7 | 0·031 | 0·031 |
| 26 | „ .. | 1 | 2 | 3·0 | 30 | 40 | 36 | „ .. | „ .. | .. | .. | .. | .. | Opium, .. | 5 | 4·56 | 22·8 | 250·8* | .. | .. | .. | .. | .. | .. | Paleo, .. | 1 | 0·72 | 8 | 0·045 | 0·045 |
| 27 | „ .. | 1 | 1 | .. | 21 | .. | .. | „ | „ .. | .. | .. | .. | .. | Do. & Vegetable, | 10 | 0·90 | 9·0 | 69·3 | .. | .. | .. | .. | .. | .. | Opium, .. Vegetables, | x | 0·90 | 7 | 0·130 | 0·130 |
| 29 | „ .. | 1 | 1 | 3·0 | 20 | 23 | 21·5 | Rakur, .. | Cotton, .. | 2 | 2·6 | 5·2 | 20·8 | Vegetables, .. | 10 | 2·6 | 26·0 | 100 | .. | .. | .. | .. | .. | .. | Vegetables, | x | 2·6 | .. | 0·136 | 0·136 |
| 31 | „ .. | 2 | 1 | 1·65 | 16 | 28 | 22 | Parwa, .. | „ .. | .. | .. | .. | .. | Tobacco, .. | 7 | 2·83 | 19·8 | 79 2 | .. | .. | .. | .. | .. | .. | Tobacco, .. | x | 2·83 | .. | 0·327 | 0·163 |
| 32 | „ .. | 1 | 2 | 2·4257 | 20 | 28 | 23·5 | „ .. | „ .. | .. | .. | .. | .. | Tobacco, .. | 10 | 4 00 | 40·0 | 102 | .. | .. | .. | .. | .. | .. | Tobacco, .. | 2 | 4·00 | 11 | 0·18 | 0·18 |
| 33 | „ .. | 1 | 1 | 2·836 | 29 | 35 | 32 | „ .. | „ .. | .. | .. | .. | .. | Tobacco, .. | 10 | .. | .. | .. | .. | .. | .. | .. | .. | .. | Tobacco, .. | 2 | .. | .. | .. | .. |
| 34 | „ .. | 1 | 1 | 2 06 | 10·5 | 14 | 12·25 | „ .. | „ .. | .. | .. | .. | .. | Barley, .. | 6 | 2 0 | 12·0 | 63·6 | .. | .. | .. | .. | .. | .. | Barley, .. | 1 | 2·0 | 8 | 0·25 | 0·25 |
| 35 | „ .. | 1 | 1 | 1·5 | 19 | 20 | 19·5 | „ .. | „ .. | .. | .. | .. | .. | Barley, .. | 6 | 4·7 | 28·2 | 197·4 | .. | .. | .. | .. | .. | .. | Barley, .. | 1 | 0·6 | 4¼ | 0·148 | 0·148 |

* No Kyaries.

TABLE A.—*Observation and Experiment*—(Continued).

| Serial Number. | EXPERIMENTAL. WORK. Duration of work minutes. | No. of lifts. | Cubic feet lifted. Per pair of cattle per hour. | Per lift, per hour. | Total per well. | H. P. Per bullock. | Total per well. | Length of water course. | Area Irrigated. Crop. | Watering. | Interval. | Area in square feet | Depth. On area. | Of dump. | Days to an Acre. Per pair of cattle. | Per lift. | Per well. | Duty per pair. | COST. Annual. Interest at 5 p. c. | Repairs, &c. | Total. | Per Acre. Per acre Irrigated. | Lifting. | Total. | Remarks. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 92 | 93 | 94 | 95 | 96 | 97 | 98 | 99 | 100 | 101 | 102 | 103 | 104 | 105 | 106 | 107 | 108 | 109 | 110 | 111 | 112 | 113 | 114 | 115 | 116 |
| 2 | 400 | 430 | 77·4 | 193·7 | 1,290 | ·878 | 351 | 200 | Wheat, .. | 1 | .. | 4,410 | ·292 | .. | 24·5 | 19 6 | 9·8 | .. | 10·4 | 11·0 | 21·4 | 3·0 | 19·2 | 21·2 | Wheat. |
| 3 | .. | .. | .. | .. | .. | .. | .. | 100 | Paleo, .. | 1 | .. | 2,380 | .. | .. | 18·5 | 18·5 | 18·5 | .. | 1·2 | 12·0 | 13·2 | 2·6 | 17·4 | 20 0 | „ |
| 5 | .. | .. | .. | .. | .. | .. | .. | .. | Wheat, .. | 1 | .. | 2,100 | .. | .. | 20·7 | 20·7 | 20·7 | .. | 1·0 | 8·5 | 9·5 | 2·1 | 19·4 | 21·5 | „ |
| 8 | .. | .. | .. | .. | .. | .. | .. | .. | Mixed, .. | 1 | .. | 7,300 | .. | .. | 12·0 | 12·0 | 6·0 | .. | 1·5 | 19·0 | 20·5 | 3·5 | 18·0 | 21·5 | „ |
| 9 | .. | .. | .. | .. | .. | .. | .. | .. | Mixed, .. | .. | .. | 7,464 | .. | .. | 11·6 | 11·6 | 5·8 | .. | 1·5 | 19·0 | 20·5 | 3·7 | 16·3 | 20·0 | Opium. |
| 11 | .. | .. | .. | .. | .. | .. | .. | .. | Wheat, .. | 1 | .. | 5,476 | .. | .. | 16·0 | 16·0 | 8·0 | .. | 1·5 | 19·0 | 20·5 | 14·7 | 6·5 | 10·2 | Wheat and Barley. |
| 12 | .. | .. | .. | .. | .. | .. | .. | .. | Wheat, .. | 1 | .. | 5,500 | .. | .. | 16·0 | 16·0 | 8·0 | .. | 1·5 | 19·0 | 20·5 | 3·8 | 13·5 | 32·7 | Wheat. |
| 13 | .. | .. | .. | .. | .. | .. | .. | .. | Opium, .. | 1 | .. | 17,766 | .. | .. | 7 5 | 7·5 | 2·5 | .. | 15·6 | 16·0 | 31·6 | 2·4 | 12·0 | 17·3 | Wheat. |
| 16 | .. | .. | .. | .. | .. | .. | .. | .. | Closed will assume, | .. | .. | 3,000 | .. | .. | 21·5 | 14·3 | 14·0 | .. | 10·2 | 6·0 | 16·2 | 3·4 | 11·4 | 14·4 | 14·8 | Gujai. |
| 17 | .. | .. | .. | .. | .. | .. | .. | .. | Opium, .. | 1 | .. | 4,000 | .. | .. | 11·0 | 11·0 | 11·0 | .. | 15·2 | 6·0 | 21·2 | .. | 23·4 | .. | Opium. |
| 18 | 460 | 203 | 50·0 | 50·0 | 380 | 1·36 | 628 | 100 | Vegetables, | x | 3 days, | 4,752 | ·09 | .. | 9·0 | 9·0 | 9 0 | .. | 15·1 | 3·0 | 18·1 | .. | 28·0 | .. | Vegetables. |
| 20 | 540 | 390 | 126·6 | 126·6 | 1,140 | ·520 | 281 | 400 | Wheat, .. | 1 | .. | 1,498 | ·69 | .. | 29·0 | 29·0 | 29.0 | .. | 10·3 | 7·0 | 17·3 | 7·5 | 24·4 | 31·9 | Wheat. |
| 21 | 530 | 776 | 114·2 | 114·2 | 4,034 | ·700 | 366 | 300 | „ .. | 1 | .. | 15,765 | ·128 | .. | 5·5 | 5 5 | 2·8 | .. | 21·2 | 25·0 | 46·2 | 2·8 | 4·7 | 7·5 | Wheat (Cost calculated at 1·4 days per acre for three days' work.) |
| 22 | 530 | 776 | 114·2 | 114·2 | | | | 1,150 | „ .. | 1 | .. | 1,442 | .. | .. | 60·0 | 60·0 | 30·0 | .. | | | | | 3·2 | 6·0 | Barley |
| 528 | 527 | 384 | 115 | 115 | 1,014 | 1·567 | 826 | 270 | Tobacco, .. | 12 | 12 days, | 7,550 | ·13 | ·75 | 5·6 | 5·6 | 5·6 | .. | 1·5 | 6·0 | 7·5 | 1·1 | 25·2 | 26·3 | Potatoes. |
| | | | | | | | | | Garden, .. | 8 | | | | | | | | | | | | | 25·2 | 26 3 | Tobacco. |
| | | | | | | | | | | | | | | | | | | | | | | | 16·8 | 17·9 | Garden. |
| | | | | | | | | | | | | | | | | | | | | | | | 8·4 | 9·5 | Wheat. |
| 533 | 530 | 456 | 133 | 133 | 1,181 | 2·091 | 1,110 | 160 | Tobacco, .. | 10 | 12 days, | 8,165 | ·14 | ·70 | 5·3 | 5·3 | 5·3 | .. | 1·5 | 6·0 | 7·5 | 1·4 | 19·0 | 20·4 | Tobacco. |
| | | | | | | | | | | | | | | | | | | | | | | | 19·0 | 20 4 | Potatoes. |
| 24 | 480 | .. | .. | .. | .. | .. | .. | 1,000 | Paleo, .. | 1 | .. | 1,357 | .. | .. | 32·0 | 32·0 | 32·0 | .. | 10·7 | 4·0 | 14·7 | 4·9 | .. | .. | Cannot be calculated. |
| 26 | .. | .. | .. | .. | .. | .. | .. | 100 | Paleo, .. | 1 | .. | 3,920 | .. | .. | 22·0 | 22·0 | 11·0 | .. | 15·3 | 9·0 | 24·3 | 3·9 | .. | .. | |
| 27 | .. | .. | .. | .. | .. | .. | .. | 100 | Opium, .. | x | .. | 5,689 | .. | .. | 7·7 | 7·7 | 7·7 | .. | 15·2 | 5·0 | 20 2 | 13·4 | 23·0 | 36·4 | Opium. |
| 29 | 105 | 125 | 214 | 214 | 375 | 1·285 | 135 | 350 | Vegetables, | x | .. | 2,760 | ·136 | .. | 15 0 | 15·0 | 15·0 | .. | 10·2 | 5·0 | 15·2 | 2·9 | 47·0 | 49·9 | Garden. |
| | | | | | | | | | | | | | | | | | | | | | | | 9·4 | 12·3 | Cotton. |
| 31 | 275 day/2 | 414 | 74·55 | 149·1 | 683 | ·580 | 160 | 200 | Tobacco, .. | x | .. | 5,705 | ·119 | .. | 8·0 | 4·0 | 4·0 | .. | 10·2 | 4·0 | 14·2 | 3·3 | 14·0 | 17·3 | Tobacco. |
| 32 | 452 | 1,009 | 162·0 | 162·0 | 2,447 | 1·117 | 507 | 50 | „ .. | 2 | .. | 17,020 | ·143 | .. | 5·12 | 5·12 | 2·56 | .. | 12·8 | 9·0 | 21·8 | 3·6 | 12·8 | 16·4 | „ |
| 33 | 465 | 453 | 166·0 | 166·0 | 1,285 | 1·576 | 714 | 250 | „ .. | 2 | .. | 7,551 | ·170 | .. | 5·77 | 5·77 | 5·77 | .. | 10 2 | 5·0 | 15·2 | .. | 18·0 | .. | „ |
| 34 | 410 | 553 | 167 | 167 | 1,139 | ·629 | 252 | 150 | Barley, .. | 1 | .. | 8,286 | ·137 | .. | 5·3 | 5·3 | 5·3 | .. | 5·2 | 4·0 | 9·2 | 3·1 | 9 6 | 12·7 | |
| 35 | 385 | 557 | 130 | 130 | 835 | ·717 | 276 | 130 | Barley, .. | 1 | .. | 6,020 | ·138 | 0·66 | 7·0 | 7·0 | 7·0 | .. | 0·4 | 4·0 | 4·4 | 0·6 | 13·2 | 13·8 | |

TABLE A.—*Observation and Experiment*—(Continued).

STATISTICAL.

| Serial Number. | Province. | District. | Locality: Pergunna. | Locality: Village. | Year. | Area in Acres: Actual area in acres. | Area in Acres: Percentage uncultivated: Waste. | Area in Acres: Percentage uncultivated: Culturable. | Cultivated Area: Percentage of actual area cultivated. | Cultivated Area: Double cropped area in acres. | Cultivated Area: Total area actually cultivated in the year. | Percentage of Total Cultivated Area: Wet. | Percentage of Total Cultivated Area: Dry. | Kharif: Wet: Wells. | Kharif: Wet: Canals. | Kharif: Wet: Other sources. | Kharif: Dry. | Kharif: Total. | Rabi: Wet: Wells. | Rabi: Wet: Canals. | Rabi: Wet: Other sources. | Rabi: Dry. | Rabi: Total. | Irrigation Wells: Lime masonry. | Irrigation Wells: Dry bricks. | Irrigation Wells: Kacha. | Irrigation Wells: Total. | Lifts: Leather bucket. | Lifts: Earthen pots. | Lifts: Total. | Usual labor for lifting buckets. | Average area per lift, in acres: Kharif. | Average area per lift, in acres: Rabi. | Average area per lift, in acres: Total. | Remarks. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 |
| 36 | | | Panwári, .. | Deoganpura, | 1879-80 | 1026·0 | 5·85 | 10·41 | 33·74 | .. | 859·1 | 0·03 | 99·97 | 0·03 | .. | .. | 34·97 | 35·0 | .. | .. | .. | 65·0 | 65·0 | 5 | .. | .. | 5 | 5 | .. | 5 | Bullocks, | 0·05 | .. | 0·05 | No kacha wells. |
| 37 | | | „ .. | „ .. | 80-81 | 1026·0 | 5·68 | 11·00 | 33·32 | .. | 854·6 | 0·30 | 99·70 | 0·06 | .. | .. | 28·70 | 28·76 | 0·24 | .. | .. | 71·0 | 71·24 | 5 | .. | .. | 5 | 5 | .. | 5 | „ | 0·10 | 0·41 | 0·51 | |
| 38 | | | „ .. | Panwári, .. | 79-80 | 2810·2 | 7·39 | 12·70 | 79·91 | .. | 2245·4 | 1·03 | 98·97 | 0·51 | .. | .. | 38·48 | 38·99 | 0·52 | .. | .. | 60·49 | 61·01 | 13 | .. | .. | 13 | 13 | .. | 13 | „ | 0·9 | 0·9 | 1·8 | |
| 39 | | | „ .. | „ .. | 80-81 | 2810·2 | 7·38 | 13·98 | 78·64 | 53·8 | 2263·5 | 0·80 | 99·20 | 0·10 | .. | .. | 39·00 | 39·10 | 0·70 | .. | .. | 60·20 | 60·90 | 13 | .. | .. | 13 | 13 | .. | 13 | „ | 0·13 | 1·2 | 1·33 | |
| 40 | | | „ .. | Alipura, .. | 80-81 | 253·15 | 4·90 | 25 90 | 69·20 | 0·88 | 176·03 | 1·65 | 98·35 | 0·23 | .. | .. | 85·72 | 85·95 | 1·42 | .. | .. | 12·63 | 14·05 | 1 | .. | .. | 1 | 1 | .. | 1 | „ | 0·04 | 2·49 | 2·53 | Only well in village. |
| 41 | | | Jaitpur, .. | Morari, .. | 79-80 | 4554· | 35·0 | 31·6 | 33·4 | .. | 15·26 | 6·56 | 93·14 | 0·39 | .. | .. | 76·10 | 76·49 | 3·45 | .. | 2·72 | 17·34 | 23·51 | .. | .. | .. | 35 | 47 | .. | 47 | „ | 0·13 | 1·17 | 1·30 | |
| 42 | | | „ .. | „ | 80-81 | 4554· | 34·8 | 30.02 | 35·18 | .. | 16·02 | 7·22 | 92·78 | 0·29 | .. | .. | 67·66 | 67·95 | 4·07 | 1·26 | 1·60 | 25·12 | 32·05 | .. | .. | .. | 35 | 47 | .. | 47 | „ | 0·12 | 1·30 | 1·42 | |
| 43 | | | „ .. | Jaitpur, .. | 79-80 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 130 | .. | .. | .. | .. | .. | .. | „ | .. | 1·77 | .. | Tank fed wells. |
| 45 | | | Ráth, .. | Ráth, .. | 79-80 | 7875· | 9·37 | 25·37 | 65·26 | .. | 51·41 | 3·34 | 96·66 | 1·43 | .. | .. | 31·58 | 33 01 | 1·91 | .. | .. | 65·08 | 66·99 | 24 | .. | 23 | 47 | 53 | .. | 53 | „ | 1·20 | 1·85 | 3·05 | |
| 46 | | | „ .. | „ .. | 80-81 | 7875· | 9·37 | 24·25 | 65·88 | .. | 51·90 | 2·97 | 97·03 | 1·20 | .. | .. | 37·12 | 38·32 | 1·77 | .. | .. | 59·91 | 66·68 | 19 | .. | 14 | 33 | 39 | .. | 39 | „ | 1·60 | 2·35 | 3·95 | |
| 58 | N. W. P. | Hamirpur. | Ráth, .. | Jareva, .. | 82-83 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 4 | .. | .. | 4 | 6 | .. | 6 | „ | .. | ·30 | 0·30 | In these villages the buckets are used also to fill vessels for drinking purposes. |
| 59 | | | Jalálpur, .. | Chandaut, .. | 82-83 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 4 | .. | 1 | 5 | 6 | .. | 6 | „ | .. | ·13 | .. | |
| 63 | | Farukhabad. | Kanauj, .. | Mirán-ki-Sarai, | 79-80 / 81-82 | 423·0 | 13·8 | 10·5 | 75·7 | 105·97 | 426·0 | 57·6 | 42·4 | 12·7 | .. | .. | 31·6 | 44·3 | 44·9 | .. | .. | 10 8 | 55·7 | 2 | .. | 137 | 139 | 140 | .. | 140 | „ | 0·38 | 1·36 | 1·74 | |
| 69 | | | Chibrámau, .. | Gursaháiganj, | 79-80 | 745·91 | 16·1 | 8·6 | 75·3 | 78·67 | 635·64 | 49·0 | 51·0 | 0·7 | .. | .. | 44·2 | 44·9 | 47·8 | .. | 0·5 | 6·8 | 55·1 | .. | .. | 137 | 137 | 171 | .. | 171 | „ | 0·02 | 1·8 | 1·82 | |
| 70 | | | „ | „ | 80-81 | 745·91 | 16·2 | 8·6 | 75·2 | 86·80 | 647·86 | 68·3 | 31·7 | 13·3 | .. | .. | 27·0 | 40·3 | 55·0 | .. | .. | 4·7 | 60·0 | .. | .. | 133 | 133 | 167 | .. | 167 | „ | 0·51 | 2·13 | 2·64 | |

TABLE A.—*Observation and Experiment*—(Continued).

| DESCRIPTIVE. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Serial Number. | *Date.* | | | Number of Well. | *Class.* | *Cost.* | | | | | | | *Supply.* | *Quality.* | *Substratum.* | *Cultivators on well.* | | *Labor and cost per day in annas.* | | | | | | | | | | | | | | |
| | Day. | Month. | Year. | | | Construction. | Fittings. | Total. | Renewal. | Lifts. | Yearly repairs. | Total. | | | | Number. | Caste. | Men, home. | Do. hired. | Rate, per day. | Cattle. | Cost for men. | Do for cattle. | Total cost, per day. | | | | | | | | |
| 37 | 38 | 39 | 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 | 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 | 61 | | | | | | | | |
| 36 | 6 | 12 | 81 | 231 | Masonry, .. | 250/- | 3/- | 253/- | .. | 3/- | 1/- | 4/- | Percolation, | Sweet, .. | Gravel, .. | 1 | Kachi, .. | 3 | .. | .. | 2 | 2 | 3 | -/5/- | | | | | | | | |
| 37 | .. | .. | .. | 60 | „ .. | 250/- | 3/- | 253/- | .. | 3/- | 1/- | 4/- | „ .. | „ .. | „ .. | 1 | Lodhi, .. | 3 | .. | .. | 4 | 2 | 6 | -/8/- | | | | | | | | |
| 38 | .. | .. | .. | .. | „ .. | 150/- | 3/- | 153/- | .. | 3/- | 1/- | 4/- | „ .. | „ .. | „ .. | 1 | Kachi, .. | 3 | .. | .. | 2 | 2 | 3 | -/5/- | | | | | | | | |
| 39 | .. | .. | .. | .. | „ .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | | | | | | | | | |
| 40 | .. | .. | $\frac{13}{2083}$ | „ .. | 200/- | 3/- | 203/- | .. | 3/- | 1/- | 4/- | „ .. | „ .. | „ .. | 1 | „ .. | 3 | .. | .. | 2 | 2 | 3 | -/5/- | | | | | | | | | |
| 41 | 5 | 12 | 81 | 1307 | „ .. | 150/- | 6/- | 156/- | .. | 3/. | 1/- | 7/- | „ .. | „ .. | Rock, .. | 1 | Brahmin, .. | 4 | .. | .. | 4 | 3 | 6 | -/9/- | | | | | | | | |
| 42 | 5 | 12 | 81 | 745 | „ .. | 150/- | 6/- | 156/- | .. | 3/- | 1/- | 7/- | „ .. | „ .. | „ .. | 2 | Kachi, .. | 4 | .. | .. | 4 | 3 | 6 | -/9/- | | | | | | | | |
| 43 | 5 | 12 | 81 | .. | „ .. | 100/- | 6/- | 106/- | .. | 3/- | 1/- | 7/- | „ .. | „ .. | Gravel, .. | 2 | Brahmin, .. | 4 | .. | .. | 4 | 3 | 6 | -/9/- | | | | | | | | |
| 45 | 7 | 12 | 81 | 727 | „ .. | 250/- | 3/- | 253/- | .. | 3/- | 1/- | 4/- | „ .. | „ .. | „ .. | 7 | Kachi, .. | 3 | .. | .. | 2 | 4 | 3 | .. | | | | | | | | |
| 46 | .. | .. | .. | $\frac{731}{1205}$ | „ .. | 300/- | 6/- | 306/- | .. | 3/- | 1/- | 7/- | „ .. | „ .. | „ .. | 1 | „ .. | 4 | .. | .. | 4 | 3 | 6 | -/14/- | | | | | | | | |
| 47 | 8 | 12 | 81 | .. | „ .. | 200/- | 3/- | 203/- | .. | 3/- | 1/- | 4/- | „ .. | „ .. | „ .. | 1 | „ .. | 3 | .. | .. | 2 | 2 | 3 | -/5/- | | | | | | | | |
| 48 | .. | .. | .. | .. | Kacha, .. | 11/- | 4/- | 15/ | 9/- | 3/- | .. | 15/- | „ .. | „ .. | „ .. | 1 | Ahir, .. | 4 | .. | .. | 4 | 3 | 6 | -/9/- | | | | | | | | |
| 49 | .. | .. | .. | .. | Masonry, .. | 150/- | 6/- | 156/- | .. | 3/- | 1/- | 7/- | „ .. | „ .. | „ .. | 1 | Musalman, .. | .. | .. | 4 | .. | 8 | 6 | 12 | 1/2/- | | | | | | | | |
| 50 | .. | .. | .. | 202 | „ .. | 250/- | 3/- | 253/- | .. | 3/- | 1/- | 4/- | | | | 4 | Kachi, .. | 3 | .. | .. | 2 | 2 | 3 | | | | | | | | | | |
| 51 | .. | .. | .. | 199 | „ .. | 300/- | 6/- | 306/- | .. | 3/- | 1/- | 7/- | | | | 12 | „ .. | 4 | .. | .. | 4 | 3 | 6 | | | | | | | | | | |
| 52 | .. | .. | .. | 170 | „ .. | 300/- | 6/- | 306/- | .. | 3/- | 1/- | 7/- | „ .. | „ .. | „ .. | 6 | „ .. | 4 | .. | .. | 4 | 3 | 6 | 1/12/- | | | | | | | | |
| 53 | .. | .. | .. | 168 | „ .. | 250/- | 3/- | 253/- | .. | 3/- | 1/- | 4/- | | | | 1 | „ .. | 3 | .. | .. | 2 | 2 | 3 | | | | | | | | | | |
| 54 | .. | .. | .. | 227 | „ .. | 300/- | 6/- | 306/- | .. | 3/- | 1/- | 7/- | | | | 21 | „ .. | 4 | .. | .. | 4 | 3 | 6 | | | | | | | | | | |
| 55 | .. | .. | .. | 117 | „ .. | 300/- | 6/- | 306/- | .. | 3/- | 1/- | 7/- | | | | 9 | „ .. | 4 | .. | .. | 4 | 3 | 6 | | | | | | | | | | |
| 56 | .. | .. | .. | $\frac{105}{1956}$ | „ .. | 300/- | 6/- | 306/- | .. | 3/- | 1/- | 7/- | „ .. | „ .. | „ .. | 6 | „ .. | 4 | .. | .. | 4 | 3 | 6 | 2/- | | | | | | | | |
| 57 | .. | .. | .. | 102 | „ .. | 250/- | 3/- | 253/- | .. | 3/- | 1/- | 4/- | | | | 2 | „ .. | 3 | .. | .. | 2 | 2 | 3 | | | | | | | | | | |
| 58 | 9 | 12 | 81 | .. | „ .. | 400/- | 6/- | 406/- | .. | 3/- | 1/- | 7/- | „ .. | „ .. | „ .. | 1 | „ .. | 4 | .. | .. | 4 | 3 | 6 | -/9/- | | | | | | | | |
| 59 | 10 | .. | .. | .. | „ .. | 500/- | 3/- | 503/- | .. | 2/- | 1/- | 3/- | „ .. | „ .. | „ .. | 1 | „ .. | 3 | .. | .. | 2 | 2 | 3 | -/5/- | | | | | | | | |
| 60 | .. | .. | .. | .. | „ .. | 500/- | 6/- | 506/- | .. | 2/- | 1/- | 5/- | „ .. | „ .. | „ .. | 1 | „ .. | 4 | .. | .. | 4 | 3 | 6 | -/9/- | | | | | | | | |
| 61 | 11 | .. | .. | 1178 | „ .. | 300/- | 3/- | 303/- | .. | 2/- | 1/- | 3/- | „ .. | „ .. | „ .. | 3 | Lodhi, .. | 3 | .. | .. | 2 | 2 | 3 | -/5/- | | | | | | | | |
| 63 | 9 | 1 | 82 | .. | „ .. | 300/- | 6/- | 306/- | .. | 5/- | 1/- | 11/- | Spring, .. | „ .. | Clay, | 3 | Brahmin, | 3 | 1 | .. | 4 | 3·6 | 6 | -/9/6 | | | | | | | | |
| | | | | | | | | | | | | | | | | 4 | Kurmi, | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | 2 | Chamar, | | | | | | | | | | | | | | | |
| 66 | .. | .. | .. | .. | Kacha unlined, .. | 1·75 | 4/- | 5·75 | .. | 10/- | 1/- | 21/- | „ .. | „ .. | „ .. | 1 | Kurmi, .. | 1 | 2 | .. | 2 | 3 | 3 | -/6/- | | | | | | | | |
| 67 | .. | .. | .. | 6 wells | „ „ .. | 10·5 | 24/- | 34·5 | .. | 10/- | 7/- | 17/- | „ .. | „ .. | „ .. | x | „ .. | 12 | .. | .. | 14 | 11 | 21 | 2/- | | | | | | | | |
| | | | | | | | | | | | | | | | | 3 | Thakur, | | | | | | | | | | | | | | | |
| 69 | 10 | 1 | 82 | .. | „ „ .. | 4/- | 3/- | 7/- | .. | 10/- | 1/- | 11/- | „ .. | „ .. | „ | 2 | Kachi, | 2 | 3 | .. | 5 | 5·5 | 7·5 | -/13/- | | | | | | | | |
| | | | | | | | | | | | | | | | | 2 | Chamar, | | | | | | | | | | | | | | | |
| 72 | 10 | 1 | 82 | .. | „ „ .. | 4/- | 2/- | 6/- | .. | 10/- | 1/- | 11/- | „ .. | „ .. | „ | 6 | Thakur, Kachi, | 3 | .. | .. | 2 | 2 | 3 | -/5/- | | | | | | | | |

( II )

TABLE A.—*Observation and Experiment*—(Continued).

EXPERIMENTAL.

| Serial Number. | Run. Class. | Run. Pairs of cattle to each lift. | Lift. Number. | Lift. Content in cubic feet. | Depth to Wells. Morning. | Depth to Wells. Evening. | Depth to Wells. Mean. | Soil. | COMMAND. *Kharif* 1881-82. Crop. | Waterings required. | Area. | Total area reduced to one watering. | No. of days to area. | COMMAND. *Rabi* 1881-82. Crop. | Waterings required. | Area. | Total area reduced to one watering. | No. of days to area. | AREA IRRIGATED TO DATE. *Kharif* 1881-82. Crop. | Waterings given. | Area. | Working days to date. | Duty. Per lift. | Duty. Per pair. | *Rabi* 1881-82. Crop. | Waterings given. | Area. | Working days to date. | Duty. Per lift. | Duty. Per pair. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 62 | 62 | 63 | 64 | 65 | 66 | 67 | 68 | 69 | 70 | 71 | 72 | 73 | 74 | 75 | 76 | 77 | 78 | 79 | 80 | 81 | 82 | 83 | 84 | 85 | 86 | 87 | 88 | 89 | 90 | 91 |
| 36 | Lagor, | 1 | 1 | .. | 37 | 49 | 38·5 | Parwa, .. | Sugarcane, | 4 | .. | .. | .. | Opium, .. | 10 | 2 1 | 21·0 | 105·0 | .. | .. | .. | .. | .. | .. | Opium, .. | 4 | 2·1 | 40 | 0·21 | ·21 |
| 37 | „ | 2 | 1 | .. | 41 | .. | .. | „ .. | „ .. | 4 | 1·73 | 6·92 | 65 | Vegetables, .. | 10 | 0·9 | 9·0 | 84·6 | Sugarcane, | 4 | 1·73 | 65 | 0·10 | 0·05 | Vegetables, | x | 0·9 | x | .. | .. |
| 38 | „ | 1 | 1 | .. | 36 | .. | .. | „ .. | „ .. | .. | .. | .. | .. | Tobacco, } | 10 | 3·5 | 35·0 | 119 | „ .. | .. | .. | .. | .. | .. | Tobacco, .. | x | 3·5 | x | ·29 | ·29 |
| 39 | | | | | | | | | | | | | | Opium, } | | | | | | | | | | | Opium, .. | | | | | |
| 40 | „ | 1 | 1 | .. | 37 | .. | .. | Rakur, .. | „ .. | .. | .. | .. | .. | „ } | 10 | 1·3 | 13·0 | 156 | „ .. | .. | .. | .. | .. | .. | „ } | .. | .. | .. | ·08 | 0·8 |
| 41 | „ | 1 | 2 | .. | 11 | 17 | 14 | Parwa, .. | „ .. | .. | 1·8 | .. | .. | Vegetables, } | | | | | | | | | | | Vegetables, | | | | | |
| 42 | „ | 1 | 2 | .. | 12 | 20 | 16 | Rakur, .. | „ .. | .. | .. | .. | .. | Barley, .. | 5 | 3·4 | 14·0 | 112 | „ .. | .. | .. | .. | .. | .. | Barley, .. | 1 | 3·4 | 21 | ·06 | 0·6 |
| 43 | „ | 1 | 2 | .. | 10 | 18 | 14 | „ .. | „ .. | .. | .. | .. | .. | „ .. | 6 | 2·6 | 15·6 | 23·4 | „ .. | .. | .. | .. | .. | .. | „ .. | 1 | 2·6 | 4 | 0·325 | 0·325 |
| 45 | „ | 1 | 1 | .. | .. | 48 | 45 | Parwa, .. | „ .. | .. | .. | .. | .. | Daud Wheat, | 3 | 3·6 | 10·8 | 69 | „ .. | .. | .. | .. | .. | .. | Wheat, .. | 1 | 2·95 | 19 | 0·775 | 0·775 |
| 46 | „ | 1 | 2 | .. | 42 | .. | 45 | „ .. | „ .. | .. | .. | .. | .. | Tobacco, .. | 5 | 9 9 | 49·5 | 135 | „ .. | .. | .. | .. | .. | .. | Tobacco, .. | x | 9·9 | 28 | 1·176 | 1·176 |
| 47 | „ | 1 | 1 | 2·7 | 27 | 45 | 36 | „ .. | „ .. | .. | .. | .. | .. | „ .. | 5 | .. | .. | .. | „ .. | .. | .. | .. | .. | .. | „ .. | .. | .. | .. | .. | .. |
| 48 | „ | 1 | 2 | .. | 18 | .. | .. | Rakur, .. | „ .. | 7 | 3·0 | 21·0 | 126 | „ .. | 5 | 3·4 | 17·0 | 112 | „ .. | .. | .. | .. | .. | .. | „ .. | x | 3·4 | 25 | ·135 | ·135 |
| 49 | „ | 2 | 2 | .. | 18 | .. | .. | Parwa, .. | „ .. | 8 | 1·75 | 14 0 | 95 | „ .. | .. | .. | .. | .. | „ .. | 4 | 3 | 72 | ·085 | ·085 | „ .. | .. | .. | .. | .. | .. |
| 50 | „ | 1 | 1 | .. | 27 | 49 | 38 | „ .. | „ .. | .. | .. | .. | .. | „ .. | .. | .. | .. | .. | „ .. | 8 | 1 | 96 | ·072 | ·036 | „ .. | .. | .. | .. | .. | .. |
| 51 | „ | 1 | 2 | .. | 27 | 48 | 37·5 | „ .. | „ .. | .. | .. | .. | .. | „ .. | 7 | | | | „ .. | .. | .. | .. | .. | .. | „ .. | x | .. | .. | .. | .. |
| 52 | „ | 1 | 2 | .. | 30 | 45 | 37·5 | „ .. | „ .. | .. | .. | .. | .. | Opium, .. | 7 | 1·4 | ·98 | 182 | „ .. | .. | .. | .. | .. | .. | Opium, .. | .. | 14 | 26 | .09 | 0·9 |
| 53 | „ | 1 | 1 | .. | 25 | .. | .. | „ .. | „ .. | .. | .. | .. | .. | Vegetables, &c. | 7 | | | | „ .. | .. | .. | .. | .. | .. | Vegetables, &c. | .. | .. | .. | .. | .. |
| 54 | „ | 1 | 2 | .. | 30 | 54 | 42 | „ .. | | | | | | „ .. | 7 | | | | „ .. | .. | .. | .. | .. | .. | „ .. | .. | .. | .. | .. | .. |
| 55 | „ | 1 | 2 | .. | 34 | 48 | 41 | „ .. | „ .. | .. | .. | .. | .. | Tobacco, .. | 7 | 3·7 | 259 | 388 | „ .. | .. | .. | .. | .. | .. | Tobacco, .. | .. | .. | .. | .. | .. |
| 56 | „ | 1 | 1 | .. | 37 | 54 | 45·5 | „ .. | | | | | | „ .. | 7 | | | | | | | | | | | | | | | |
| 57 | „ | 1 | 1 | .. | 30 | 48 | 39 | „ .. | | | | | | „ .. | 7 | | | | | | | | | | | | | | | |
| 58 | „ | 1 | 2 | .. | 88 | .. | .. | „ .. | „ .. | .. | .. | .. | .. | Opium and Vegetables, | 7 | 0·32 | 2·24 | 33 | „ .. | .. | .. | .. | .. | .. | Opium and Vegetables, | x | 0·52 | 6 | ·027 | ·027 |
| 59 | „ | 1 | 1 | 1·7 | 113 | .. | .. | „ .. | „ .. | .. | .. | .. | .. | Opium, .. | 10 | 0·15 | 1·50 | 204 | „ .. | .. | .. | .. | .. | .. | Opium, .. | x | 0·150 | 12 | ·012 | ·012 |
| 60 | „ | 1 | 2 | .. | 111 | .. | .. | „ .. | „ .. | .. | .. | .. | .. | „ .. | 10 | 0 24 | 2·40 | 208 | „ .. | .. | .. | .. | .. | .. | „ .. | x | 0·240 | 12 | ·014 | ·014 |
| 61 | „ | 1 | 1 | .. | 57 | .. | .. | Clay, .. | „ .. | 4 | 2·27 | 9·08 | 120 | „ .. | .. | .. | .. | .. | „ .. | 2 | 2·27 | 60 | ·075 | ·075 | „ .. | .. | .. | .. | .. | .. |
| 63 | „ | 1 | 2 | 2·15 | 50 | 61 | 58·5 | Dumat, .. | „ .. | .. | .. | .. | .. | Barley, .. | 2 | 7·23 | | | | | | | | | Barley, .. | 1 | 7·23 | | | |
| | | | | | | | | | | | | | | Wheat, .. | 3 | 1·23 | 20·55 | 123·3 | | | | | | | Wheat, .. | 1 | 1·23 | 60 | 0·074 | 0·074 |
| | | | | | | | | | | | | | | Opium, .. | 6 | .. | | | | | | | | | Opium, .. | x | 0·4 | | | |
| 66 | „ | 1 | 1 | 2·95 | 54 | 60 | 57 | „ .. | „ .. | .. | .. | .. | .. | Wheat and Barley, | 3 | 2·11 | 6·33 | 53 | „ .. | .. | .. | .. | .. | .. | Wheat and Barley, .. | 1 | 2·11 | x | 0·117 | 0·117 |
| 67 | „ | 1 | 7 | .. | 61 | 71 | 66 | „ .. | „ .. | .. | .. | .. | .. | Barley, .. | 1 | 30·3 | 41·5 | 79 | „ .. | .. | .. | .. | .. | .. | Wheat, .. | 1 | 5·6 | 60 | 0·05 | 0·05 |
| | | | | | | | | | | | | | | Wheat, .. | 2 | 5·6 | | | | | | | | | Barley, .. | 1 | 11·0 | | | |
| | | | | | | | | | | | | | | Barley, .. | 2 | 1 43 | | | | | | | | | Barley, .. | 1 | 1·43 | 7 5 | 0·095 | 0·076 |
| | | | | | | | | | | | | | | Wheat, .. | 3 | 4 26 | 28·0 | 123·2 | | | | | | | Wheat, .. | 1 | 4·26 | 21·0 | 0·100 | ·008 |
| | | | | | | | | | | | | | | Opium, .. | 6 | 2·06 | | | | | | | | | Opium, .. | 2 | 2·06 | 10·0 | 0·206 | 0·164 |
| | | | | | | | | | | | | | | Barley, .. | 2 | 2·66 | 14·14 | 137 | | | | | | | Barley, .. | 1 | 2·66 | 22·0 | 0·120 | 0·120 |
| | | | | | | | | | | | | | | Opium .. | 7 | 1·26 | | | | | | | | | Opium .. | 2 | 1·26 | 20·0 | 0·126 | 0·126 |
| | Average. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 69 | „ | 1·25 | 2 | 2·7 | 46 | .. | .. | „ .. | „ .. | .. | .. | .. | .. | | | | | | | | | | | | | | | | | |
| 72 | „ | 1 | 1 | 3·6 | 44 | 50 | 47 | „ .. | „ .. | .. | .. | .. | .. | | | | | | | | | | | | | | | | | |

TABLE A.—*Observation and Experiment*—(Continued).

| Serial Number. | EXPERIMENTAL. WORK. Duration of work minutes. | No. of lifts. | Cubic feet lifted. Per pair of cattle per hour. | Per lift, per hour. | Total per well. | H. P. Per bullock. | Total per well. | Length of watercourse. | Area Irrigated. Crop. | Watering. | Interval. | Area in square feet. | Depth. On area. | Of damp. | Days to an Acre. Per pair of cattle. | Per lift. | Per well. | Duty per pair. | COST. Annual. Interest at 5 p. c. | Repairs, &c. | Total. | Per Acre. Per acre Irrigated. | Lifting. | Total. | Remarks. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 92 | 93 | 94 | 95 | 96 | 97 | 98 | 99 | 100 | 101 | 102 | 103 | 104 | 105 | 106 | 107 | 108 | 109 | 110 | 111 | 112 | 113 | 114 | 115 | 116 |
| 36 | ... | ... | ... | ... | ... | ... | ... | ... | Opium, ... | 5 | ... | 9,147 | .. | ... | 5·0 | 5·0 | 5·0 | ... | 12·6 | 4·0 | 16·6 | 5·0 | 15·6 | 20·6 | Opium. |
| 37 | ... | ... | ... | ... | ... | ... | ... | ... | Sugar, ... | ... | ... | 4,611 | ... | ... | 9·4 | 9·4 | 9·4 | ... | 12·6 | 4·0 | 16·6 | 6·0 | 6·2 / 18·8 | 11·2 / 24·8 | Sugarcane. / „ |
| 38 | ... | ... | ... | ... | ... | ... | ... | ... | Tobacco, / Opium, | ... | ... | 12,753 | ... | ... | 3·4 | 3·4 | 3·4 | ... | 7·7 | 4·0 | 11·7 | 2·2 | 10·6 | 12·8 / 12·8 | Tobacco. / Opium. |
| 40 | ... | ... | ... | ... | ... | ... | ... | 500 | Opium, ... | ... | ... | 3,610 | ... | ... | 12·0 | 12·0 | 12·0 | ... | 10·1 | 4·0 | 41·1 | | | | |
| 41 | ... | ... | ... | ... | ... | ... | ... | 300 | Barley, ... | 1 | ... | 5,272 | ... | ... | 16·0 | 16·0 | 8·0 | ... | 7·8 | 7·0 | 14·8 | | | | |
| 42 | ... | ... | ... | ... | ... | ... | ... | 200 | „ ... | 1 | ... | ... | ... | ... | 3·0 | 3·0 | 1·5 | ... | 7·8 | 7·0 | 14·8 | | | | |
| 43 | ... | ... | ... | ... | ... | ... | ... | 150 | „ ... | 1 | ... | 6.787 | ... | ... | 12·8 | 12·8 | 6·4 | ... | 5·3 | 7·0 | 12·3 | | | | |
| 45 | ... | ... | ... | ... | ... | ... | ... | 50 | Tobacco, ... | x | ... | 5,303 | ... | ... | 8·2 | 8·2 | 2·73 | ... | 28·0 | 11·0 | 39·0 | | | | |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | „ ... | ... | ... | ... | ... | ... | ... | ... | ... | | | | | | | | |
| 47 | 440 | 424 | 157 | 157 | 1,145 | 1·882 | 828 | 256 | „ ... | x | ... | 6,590 | ·174 | ... | 6·6 | 6·6 | 6·6 | ... | 11·5 | 4·0 | 15·5 | | | | |
| 48 | ... | ... | ... | ... | ... | ... | ... | 200 | Sugar, ... | 2 | ... | 3,630 | ... | ... | 12·0 | 12·0 | 6 0 | ... | ·7 | 15·0 | 15·7 | | | | |
| 49 | ... | ... | ... | ... | ... | ... | ... | 250 | „ ... | 2 | ... | 6,352 | ... | ... | 27·2 | 13·6 | 6·8 | ... | 7·8 | 7·0 | 14·8 | | | | |
| 50 | ... | .. | ... | ... | ... | ... | ... | ... | Tobacco, ... | x | ... | average of 10 measurements. | ... | ... | 11·17 | 11·17 | | | | | | | | | |
| 51 | ... | ... | ... | ... | ... | ... | ... | ... | Opium, ... | ... | ... | | ... | ... | 11·17 | 11·17 | 1·86 | ... | 56·0 | 22·0 | 78·0 | | | | |
| 52 | ... | ... | ... | ... | ... | ... | ... | ... | Vegetables, ... | ... | ... | | ... | ... | 11·17 | 11·17 | | | | | | | | | |
| 53 | ... | ... | ... | ... | ... | ... | ... | ... | „ ... | ... | ... | 23,400 | ... | ... | 11·17 | 11·17 | | | | | | | | | |
| 54 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 55 | ... | ... | ... | ... | ... | ... | ... | .. | „ ... | ... | ... | 28,000 | ... | ... | 10·8 | 10·8 | 1·5 | ... | 58·0 | 25·0 | 83·0 | | | | |
| 56 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 57 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 58 | ... | ... | ... | ... | ... | ... | ... | 100 | Opium, / Vegetables, | x | ... | 2,969 | ... | ... | 30 | 30 | 15 | ... | 20·3 | 7·0 | 27·3 | | | | |
| 59 | 300 $\frac{\text{days}}{2}$ | 118 | 40 | 40 | $\frac{47\,I}{153\,D}$ | 1·465 | 879 | 100 | Opium, | x | ... | 160 | ·21 | ... | 13·6 | 13·6 | 13·6 | ... | 26·5 | 3·0 | 29·5 | | | | |
| 60 | ... | ... | ... | ... | ... | ... | ... | ... | „ .. | x | ... | 1,500 | ... | ... | 87 | 87 | 43 | ... | 30·3 | 3·0 | 35·3 | | | | |
| 61 | .. | ... | ... | ... | ... | ... | ... | ... | Sugar, ... | 2 | ... | 3,296 | ... | ... | 13·2 | 13·2 | 13·2 | ... | 15·1 | 3·0 | 18·1 | | | | |
| 63 | 500 | 376 | 72·0 | 72·0 | 1,184 | 1·160 | 580 | 510 | Barley, .. | 1 | ... | 7,200 | ·164 | ... | 12 | 12 | 6 | ... | 15·3 | 11·0 | 26·3 | | | | |
| 66 | 485 | 206 | 73·3 | 73·3 | 608 | 1·250 | 606 | 440 | „ ... | 1 | ... | 5,100 | ·119 | ... | 8·4 | 8·4 | 8·4 | ... | 0·3 | 21·0 | 21·3 | | | | |
| 67 | ... | ... | ... | ... | ... | ... | ... | 1,150 | Wheat, .. | 1 | ... | 22,340 | ... | .. | 13·3 | 13·3 | 1·9 | ... | 1·7 | 77·0 | 78·7 | | | | |
| 69 | 540 | 572 | 75·4 | 85·8 | 1,544 | ·854 | 461 | 510 | „ ... | 1 | ... | 9,862 | ·156 | ... | 10·7 | 8·9 | 4·4 | ... | 0·4 | 21·0 | 21·4 | | | | |
| 72 | 540 | 283 | 11·4 | 11·4 | 10·26 | 1·509 | 815 | 450 | „ ... | 1 | ... | 4,514 | ·227 | ... | 9·7 | 9·7 | 9 7 | ... | 0·3 | 11·0 | 11·3 | | | | |

TABLE A.—*Observation and Experiment*—(Continued).

STATISTICAL.

| Serial Number. | Locality. Province. | Locality. District. | Locality. Pergunna. | Locality. Village. | Year. | Area in Acres. Actual area in acres. | Area in Acres. Percentage uncultivated. Waste. | Area in Acres. Percentage uncultivated. Culturable. | Cultivated Area. Percentage of actual area cultivated. | Cultivated Area. Double cropped area in acres. | Cultivated Area. Total area actually cultivated in the year. | Percentage of Total Cultivated Area. Wet. | Percentage of Total Cultivated Area. Dry. | Kharif. Wet. Wells. | Kharif. Wet. Canals. | Kharif. Wet. Other sources. | Kharif. Dry. | Kharif. Total. | Rabi. Wet. Wells. | Rabi. Wet. Canals. | Rabi. Wet. Other sources. | Rabi. Dry. | Rabi. Total. | Irrigation Wells. Lime masonry. | Irrigation Wells. Dry bricks. | Irrigation Wells. Kacha. | Irrigation Wells. Total. | Lifts. Leather bucket. | Lifts. Earthen pots. | Lifts. Total. | Usual labor for lifting buckets. | Average area per lift, in acres. Kharif. | Average area per lift, in acres. Rabi. | Average area per lift, in acres. Total. | Remarks. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 |
| 74 | N. W. P. | FARUKHABAD. | Chibrámau, .. | Deobarmpur, | 1879-80 | 345·7 | 13·4 | 19·6 | 67·0 | 40·32 | 273·3 | 40·8 | 59·2 | 1·8 | .. | .. | 42·6 | 44·4 | 39·0 | .. | .. | 16·6 | 55·6 | .. | .. | 57 | 57 | 65 | .. | 65 | .. | 0·07 | 1·64 | 1·71 | |
| 75 | | | „ .. | „ .. | 80-81 | 345·7 | 13·4 | 19·6 | 67·0 | 47·21 | 278·6 | 47·5 | 52·5 | 1·8 | .. | .. | 44 4 | 46·2 | 35·4 | 10·3 | .. | 8·1 | 53·8 | .. | .. | 57 | 57 | 65 | .. | 65 | .. | 0·07 | 1·52 | 1·59 | |
| 86 | | | Amrutpur, .. | Rajaipur, .. | 79-80 | 952·2 | 17·3 | 6·5 | 76·2 | .. | 704·9 | 2·1 | 99·9 | .. | .. | .. | 0·9 | 0·9 | 2·1 | .. | .. | 97·0 | 99·1 | 1 | 2 | 16 | 19 | .. | 21 | 21 | Men | .. | 0·7 | 0·7 | |
| 87 | | | „ .. | „ .. | 80-81 | 952 2 | 19·3 | 6·8 | 73·9 | 198·3 | 881·5 | 6·5 | 93·5 | 0·7 | .. | .. | 55·6 | 56·3 | 5·8 | .. | .. | 37·9 | 43·7 | 1 | 2 | 68 | 71 | .. | 74 | 74 | „ | 0·08 | 0·7 | 0·7 | |
| 88 | | | Farukhabad,.. | Khampur, .. | 79-80 | 222 | 11·44 | 18·45 | 70·11 | 127·5 | 283·13 | 56·53 | 43·47 | 2·09 | .. | .. | 40·92 | 43·01 | 53·87 | .. | 0·57 | 2·55 | 56·99 | .. | 2 | 61 | 63 | 63 | .. | 63 | Bullock | 0 09 | 2·41 | 2·50 | |
| | | | „ .. | „ .. | 80-81 | 222 | 11·55 | 14·33 | 74·12 | 152·94 | 317·48 | 77·90 | 22·10 | 26·55 | .. | .. | 21·25 | 47·80 | 51·35 | .. | .. | 0·85 | 52·20 | .. | 5 | 61 | 66 | 66 | .. | 66 | „ | 1·25 | 2·47 | 3·72 | |
| | | | „ | „ .. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 92 | | | Tálgrám, .. | Tajpur, .. | 79-80 | 129·14 | 14·5 | 46·5 | 39·0 | 45·83 | 96·17 | 78·9 | 21·1 | 2·4 | .. | .. | 10·0 | 12·4 | 76·5 | .. | .. | 11·1 | 87·5 | .. | 12 | 33 | 45 | 33 | .. | 33 | „ | 0·08 | 2·33 | 2·41 | |
| | | | | | 80-81 | 129·14 | 14·5 | 46·6 | 38·9 | 51·23 | 101·46 | 88·6 | 11·4 | 33·5 | .. | .. | 10·6 | 44·1 | 55·1 | .. | .. | 0·8 | 55·9 | .. | 12 | 33 | 45 | 33 | .. | 33 | „ | 1·00 | 1·68 | 2·68 | |
| 96 | | | Bhongaon, .. | Bewar, .. | 79-80 | 2370·9 | 10·35 | 26·11 | 63·54 | 70·4 | 15·77 | 9·91 | 80·09 | ·67 | .. | .. | 48·46 | 49·13 | 8·88 | .. | ·36 | 41·65 | 50·87 | 4 *p*·1<br>2 *p*·4 | .. | 2 *p*·2<br>1 *p*·112 | 119 | 128 | .. | 128 | „ | 0·08 | 1·09 | 1·17 | |
| 98 | | | „ .. | „ .. | 80-81 | 2370·9 | 10·35 | 16·85 | 72·80 | .. | 17·26 | 40·35 | 59·65 | ·13 | ·77 | ·18 | 43·39 | 44·97 | 8·53 | 27·76 | 2·98 | 15·76 | 55·03 | 4 *p*·1<br>2 *p*·4 | .. | 1 *p*·89 | 94 | 101 | .. | 101 | „ | 0·02 | 1·45 | 1·47 | First year of Canal, note effect. |
| 100 | | | Mainpuri, .. | Mainpuri, .. | 79-80 | 2662·3 | 23·56 | 24·83 | 51·61 | 20·4 | 15·78 | 42·50 | 57·50 | 1·68 | 0·84 | 0·08 | 49·02 | 51·62 | 22·48 | 2·76 | 14·66 | 8·48 | 48·38 | 123 | .. | 19 | 142 | 125 | .. | 125 | „ | 0·21 | 2·84 | 3·05 | All these wells have splendid springs. |
| 101 | | | „ .. | Bonamai, .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | |
| 102 | | | „ .. | „ .. | 80-81 | 2662·3 | 23·06 | 26·22 | 50·72 | 240·4 | 1590·8 | 53·07 | 46·93 | 11·86 | 2·14 | 0·52 | 42·24 | 56·76 | 21·75 | 3·74 | 13·06 | 4·69 | 43·24 | 125 | .. | 10 | 135 | 128 | .. | 128 | „ | 1·47 | 2·70 | 4·17 | |
| 110 | | | „ .. | Jagrapur, .. | 79-80 | 251·74 | 5·74 | 3·40 | 90·86 | 2·25 | 231 | 26 56 | 73·44 | 1·38 | .. | .. | 56·38 | 57·76 | 25·18 | .. | .. | 17·06 | 42·24 | 2 | .. | 1 | 3 | 9 | .. | 9 | .. | 0·35 | 6·62 | 6·97 | All these wells have splendid springs. |
| | | | „ .. | „ .. | 80 81 | 251·74 | 7·0 | 6·02 | 86·98 | 12·4 | 231·34 | 28·6 | 71·4 | 4·6 | .. | .. | 62·8 | 67·4 | 24·0 | .. | .. | 8·6 | 32·6 | 3 | .. | .. | 3 | 10 | .. | 10 | .. | 1·06 | 5·55 | 6·61 | |

TABLE A.—*Observation and Experiment*—(Continued).

| DESCRIPTIVE. | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Serial Number. | *Date.* | | | Number of Well. | *Class.* | *Cost.* | | | | | | | *Supply.* | *Quality.* | *Substratum.* | *Cultivators on well.* | | *Labor and cost per day in annas.* | | | | | | | | | | |
| | Day. | Month. | Year. | | | Construction. | Fittings. | Total. | Renewal. | Lifts. | Yearly repairs. | Total. | | | | Number. | Caste. | Men, home. | Do. hired. | Rate, per day. | Cattle. | Cost for men. | Do for cattle. | Total cost, per day. | | | | | |
| 37 | 38 | 39 | 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 | 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 | 61 | | | | | |
| 74 | 11 | 1 | 82 | 160 | Kacha lined, .. | 3·75 | 3/- | 6·75 | .. | 7/- | 1/- | 8/- | .. | .. | .. | 1 | Kachi, .. | 2 | 1 | .. | 2 | 2·5 | 3 | -/5/6 | | | | | |
| 78 | 11 | 1 | 82 | 165 | „ „ .. | 3·75 | 3/- | 6·75 | .. | 7/- | 1/- | 8/- | .. | .. | .. | 3 | „ .. | 2 | 1 | .. | 2 | 2·5 | 3 | -/5/6 | | | | | |
| 80 | .. | 1 | 82 | 81 | „ „ .. | 5/- | 3/- | 8/- | .. | 7/- | 1/- | 8/- | .. | .. | .. | 1 | „ .. | 3 | .. | .. | 2 | 2 | 3 | -/5/6 | | | | | |
| 84 | 11 | 1 | 82 | 177 | „ „ .. | 3·75 | 3/- | 6·75 | .. | 7/- | 1/- | 8/- | .. | .. | .. | 1 | „ .. | 3 | .. | .. | 2 | 2 | 3 | -/5/- | | | | | |
| 86 | 12 | 4 | 82 | .. | „ „ .. | 1·5 | 1/- | 2·5 | 1/- | ·5 | .. | 1·5 | .. | .. | Sand, .. | 1 | „ .. | 1 | .. | .. | .. | 1 | .. | -/1/- | | | | | |
| 87 | .. | .. | .. | .. | „ „ .. | 1·5 | 1/- | 2·5 | 1/- | ·5 | .. | 1·5 | .. | .. | „ .. | 1 | „ .. | 2 | .. | .. | .. | 1 | .. | -/1/- | | | | | |
| 88 | 13 | 4 | 82 | .. | Kacha unlined, .. | 3/- | 3/- | 6/- | .. | 10/- | 1/- | 11/- | Spring, .. | Sweet, .. | Clay, .. | 1 | „ .. | 1 | 1 | 1·9 | 2 | 34 | 3 | -/6/5 | | | | | |
| | | | | | | | | | | | | | | | | | | | 1 | 1·5 | | | | | | | | |
| 90 | 13 | 4 | 82 | 23 | „ „ .. | 3/- | 3/- | 6/- | .. | 9/- | 1/- | 10/- | „ .. | „ .. | „ .. | 1 | „ .. | 1 | 1 | 2·0 | .. | 3 | 3 | -/6/- | | | | | |
| | | | | | | | | | | | | | | | | | | | 1 | 1·0 | 2 | | | | | | | |
| 92 | 15 | 4 | 82 | 1 2 6 / 1 | Kacha lined, .. | 5/- | 3/- | 8/- | 1·5 | 8/- | 1/- | 10·5 | „ .. | „ .. | „ .. | 1 | „ .. | 3 | .. | .. | 2 | 2 | 3 | -/5/- | | | | | |
| 94 | 15 | 4 | 82 | 135 | „ „ .. | 5/- | 3/- | 8/- | 1·5 | 8/- | 1/- | 10·5 | „ .. | „ .. | „ .. | 1 | Lodha, .. | 1 | 2 | 2 | 2 | 4 | 3 | -/7/- | | | | | |
| 96 | 13 | 1 | 82 | 1,124 | Masonry, .. | 250/- | 6/- | 256/- | .. | 5/- | 1/- | 11/- | Percolation, | „ .. | Sand, .. | .. | „ .. | 1 | 3 | ·75 | 4 | 3·0 | 6 | -/10/6 | | | | | |
| | | | | | | | | | | | | | | | | | | | 1 | 1·6 | .. | 1·5 | | | | | | |
| 99 | 13 | 1 | 82 | 281 | „ .. | 250/- | 3/- | 253 - | .. | 5/- | 1/- | 6/- | Spring, .. | „ .. | Clay, .. | 1 | Brahmin, .. | 3 | .. | .. | 2 | 2 | 3 | -/5/- | | | | | |
| 100 | 15 | 1 | 82 | 2,067 | „ .. | 400/- | 12/- | 412/- | .. | 6/- | 1/- | 25/- | „ .. | „ .. | „ .. | 6 | Lodha, .. | 7 | 1 | 1·5 | 8 | 7·5 | 12 | 1/3/6 | | | | | |
| | | | | | | | | | | | | | | | | 1 | Ahir, .. | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | 1 | Chamar, .. | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | 1 | Kachi, .. | | | | | | | | | | | |
| 106 | 15 | 1 | 82 | 2,090 | „ .. | 400/- | 12/- | 412/- | .. | 5/- | 1/- | 21/- | „ .. | „ .. | „ .. | 4 | Lodha, .. | 7 | .. | .. | 8 | 6 | 12 | 1/2/- | | | | | |
| | | | | | | | | | | | | | | | | 1 | Kachi, .. | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | 1 | Ahir, .. | | | | | | | | | | | |
| 110 | 16 | 1 | 82 | 81 | „ .. | 250/- | 13/- | 263/- | .. | 4/- | 1/- | 17/- | „ .. | „ .. | „ .. | 5 | Brahmin, .. | .. | .. | .. | .. | .. | | | | | | |
| | | | | | | | | | | | | | | | | 5 | Chamar, .. | .. | .. | .. | .. | .. | 6 | 24 | 1/14/- | | |
| | | | | | | | | | | | | | | | | 2 | Lodha, .. | 7 | .. | .. | 16 | | | | | | | |

TABLE A.—*Observation and Experiment*—(Continued).

EXPERIMENTAL.

| Serial Number. | Run. Class. | Run. Pairs of cattle to each lift. | Lift. Number. | Lift. Content in cubic feet. | Depth to Wells. Morning. | Depth to Wells. Evening. | Depth to Wells. Mean. | Soil. | COMMAND. *Kharif* 1881-82. Crop. | Waterings required. | Area. | Total area reduced to one watering. | No. of days to area. | COMMAND. *Rabi* 1881-82. Crop. | Waterings required. | Area. | Total area reduced to one watering. | No. of days to area. | AREA IRRIGATED TO DATE. *Kharif* 1881-82. Crop. | Waterings given. | Area. | Working days to date. | Duty. Per lift. | Duty. Per pair. | *Rabi* 1881-82. Crop. | Waterings given. | Area. | Working days to date. | Duty. Per lift. | Duty. Per pair. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 62 | 63 | 64 | 65 | 66 | 67 | 68 | 69 | 70 | 71 | 72 | 73 | 74 | 75 | 76 | 77 | 78 | 79 | 80 | 81 | 82 | 83 | 84 | 85 | 86 | 87 | 88 | 89 | 90 | 91 |
| 74 | Lagor, .. | 1 | 1 | 3·7125 | 34 | 36 | 35 | Dumat, .. | .. | .. | .. | .. | .. | Barley, .. | 2 | 1·26 | 12·18 | 92 | .. | .. | .. | .. | .. | .. | Barley, .. | 2 | 1·26 | 16·0 | 0·157 | 0·157 |
| | | | | | | | | | | | | | | Gujai, .. | 3 | 0·86 | | | | | | | | | Gujai, .. | 2 | 0·86 | 10·0 | 0·170 | 0·170 |
| | | | | | | | | | | | | | | Wheat, .. | 4 | 0·66 | | | | | | | | | Wheat, .. | 2 | 0·66 | 8·0 | 0·160 | 0·160 |
| | | | | | | | | | | | | | | Opium, .. | 12 | 0·37 | | | | | | | | | Opium, .. | 3 | 0·37 | 6·0 | 0·185 | 0·185 |
| 78 | „ .. | 1 | 1 | 3·375 | 32 | 34 | 33 | „ .. | .. | .. | .. | .. | .. | Gujai, .. | 3 | 1·60 | 9·16 | 66 | .. | .. | .. | .. | .. | .. | Gujai, .. | 1·7 | 1·60 | 15·0 | 0·180 | 0·180 |
| | | | | | | | | | | | | | | Wheat, .. | 4 | 1·09 | | | | | | | | | Wheat, .. | 1·5 | 1·09 | 13·0 | 0·126 | 0·126 |
| | | | | | | | | | | | | | | Barley, .. | 2 | 0·943 | | | | | | | | | Barley, .. | 1 | 0·943 | 8·0 | 0·118 | 0·118 |
| 80 | „ .. | 1 | 1 | .. | 30 | 35 | 32·5 | „ .. | .. | .. | .. | .. | .. | Gujai, .. | 3 | 0·571 | 12·23 | 67 | .. | .. | .. | .. | .. | .. | Gujai, .. | 1 | 0·571 | 5·0 | 0·114 | 0·114 |
| | | | | | | | | | | | | | | Wheat, .. | 4 | 1·257 | | | | | | | | | Wheat, .. | 2 | 1·257 | 14·0 | 0·79 | 0·179 |
| | | | | | | | | | | | | | | Opium, .. | 12 | 0·300 | | | | | | | | | Opium, .. | 2 | 0·300 | 3·0 | 0·200 | 0·200 |
| 84 | „ .. | 1 | 1 | .. | 35 | .. | .. | „ .. | .. | .. | .. | .. | .. | Wheat, .. | 4 | 0·90 | 7·2 | 40 | .. | .. | .. | .. | .. | .. | Wheat, .. | 2 | 0·9 | 1·0 | 0·180 | 0·180 |
| | | | | | | | | | | | | | | Opium, .. | 12 | 0·30 | | | | | | | | | Opium, .. | 2 | 0·3 | 3 | 0·200 | 0·200 |
| 86 | Dhenkli, .. .. | | 1 | 0·4 | 15 | 15 | 15 | Matyar, .. | .. | .. | .. | .. | .. | Garden, .. | 12 | 0·6 | 7·2 | 88 | .. | .. | .. | .. | .. | .. | Garden, .. | x | 0·6 | x | 0·080 | .. |
| 87 | „ .. .. | | 1 | 0·4 | 16 | 16 | 16 | .. | .. | .. | .. | .. | .. | Garden, .. | 12 | 0·6 | 7·2 | 82 | .. | .. | .. | .. | .. | .. | Garden, .. | x | 0·6 | x | 0·086 | .. |
| 88 | Lagor, .. | 1 | 1 | 5·74 | 56 | 56 | 56 | Dumat, | Indian corn, | 2 | 1·5 | 3·46 | 18 | Potatoes, .. | 12 | 1·73 | 20·76 | 10·9 | Indian corn, | 2 | 1·5 | 9 | 0·33 | 0·33 | Potatoes, .. | 12 | 1·73 | 66 | 0·28 | 0·28 |
| | | | | | | | | | Jowar, .. | 2 | 0·23 | | | Tobacco, .. | 12 | 1·73 | 20·76 | 10·9 | Jowar, .. | 2 | 0·23 | 2 | 0·23 | 0·23 | Tobacco, .. | x | 1·73 | x | 0·20 | 0·20 |
| 90 | „ .. | 1 | 1 | 4·80 | 57 | 59 | 58 | „ .. | Indian corn, | 2 | 1·63 | 3·26 | .. | Potatoes, .. | 10 | 1·63 | 16·30 | 57 | Indian corn, | 2 | 1·63 | 10 | 0·32 | 0·32 | Potatoes, .. | 10 | 1·63 | 50 | 0·32 | .. |
| | | | | | | | | | | | | | | Tobacco, .. | 10 | 1·63 | 16·30 | 57 | | | | | | | Tobacco, .. | x | 1·63 | x | 0·28 | .. |
| 92 | „ .. | 1 | 1 | 3·82 | 35 | 37 | 36 | „ .. | Jowar, .. | 4 | 1·29 | 5·16 | 26 | Potatoes, .. | 10 | 1·29 | 12·90 | 66 | Jowar, .. | 4 | 1·29 | 20 | 0·26 | 0·26 | Potatoes, .. | 10 | 1·29 | 50 | 0·26 | 0·26 |
| | | | | | | | | | | | | | | Tobacco, .. | 10 | 1·29 | 12·90 | 66 | | | | | | | Tobacco, .. | x | 1·29 | x | 0·25 | 0·25 |
| 94 | „ .. | 1 | 1 | 4·6 | 34 | 37 | 35·5 | „ .. | Indian corn, | 0 | 1·17 | .. | .. | Potatoes, .. | 10 | 1·17 | 11·70 | 58 | Indian corn, | 0 | 1·17 | .. | .. | .. | Potatoes, .. | 10 | 1·17 | 10 | 0·19 | 0·19 |
| | | | | | | | | | | | | | | Tobacco, .. | 10 | 1·17 | 11·70 | 58 | | | | | | | Tobacco, .. | x | 1·17 | x | 0·25 | 0·25 |
| 96 | „ .. | 1 | 2 | 2·8125 | 14 | 24 | 19 | Sandy, .. | „ .. | .. | .. | .. | .. | Barley, .. | 2 | 1·23 | 12·92 | 56·7 | „ .. | .. | .. | .. | .. | .. | Barley, .. | 1 | 1·23 | 31 | 0·105 | 0·105 |
| | | | | | | | | | | | | | | Gujai, .. | 2 | 3·83 | | | | | | | | | Gujai, .. | 1 | 3·83 | | | |
| | | | | | | | | | | | | | | Wheat, .. | 3 | 1·40 | | | | | | | | | Wheat, .. | 1 | 1·40 | | | |
| 99 | „ .. | 1 | 1 | .. | 15 | .. | .. | Dumat, .. | „ .. | .. | .. | .. | .. | Wheat, .. | 3 | 1·20 | 3·60 | 21·6 | „ .. | .. | .. | .. | .. | .. | Wheat, .. | 1 | 1·20 | 6 | 0·20 | 0·20 |
| | | | | | | | | | | | | | | Gujai, .. | 3 | 5·65 | | | | | | | | | Gujai, .. | 1·8 | 5·65 | 2·5 | 0·101 | 0·101 |
| | | | | | | | | | | | | | | Barley & Gram, | 2 | 3·86 | | | | | | | | | Barley & Gram, | 1·3 | 3·86 | 9·4 | 0·133 | 0·133 |
| 100 | „ .. | 1 | 4 | 3·1725 | 16 | 27 | 21·5 | „ .. | „ .. | .. | .. | .. | .. | Wheat „ .. | 3 | 3·20 | 44·27 | 12·4 | „ .. | .. | .. | .. | .. | .. | Wheat „ | 1·6 | 3·20 | 13·1 | 0·100 | 0·100 |
| | | | | | | | | | | | | | | Garden, .. | 10 | 0·40 | | | | | | | | | Garden, .. | 7 | 0·40 | 3·5 | 0·200 | 0·200 |
| | | | | | | | | | | | | | | Opium, .. | 10 | 0·40 | | | | | | | | | Opium, .. | 3 | 0·40 | 2·1 | 0·143 | 0·143 |
| | | | | | | | | | | | | | | Tobacco, .. | 10 | 0·20 | | | | | | | | | Tobacco, .. | 4 | 0·20 | 1·2 | 0·166 | 0·166 |
| | | | | | | | | | | | | | | Barley, .. | 2 | 2·97 | | | | | | | | | Barley, .. | 1·3 | 2·97 | 8·25 | 0·117 | 0·117 |
| 106 | „ .. | 1 | 4 | 2·925 | 13 | 17 | 15 | „ .. | Sugarcane, .. | .. | .. | .. | .. | Gujai, .. | 3 | 2·77 | 40·93 | 53 | Sugarcane, .. | .. | .. | .. | .. | .. | Gujai, .. | 1·54 | 2·77 | 8·5 | 0·126 | 0·126 |
| | | | | | | | | | | | | | | Wheat, .. | 3 | 2·46 | | | | | | | | | Wheat, .. | 1·84 | 2·46 | 11 | 0·103 | 0·103 |
| | | | | | | | | | | | | | | Garden, .. | 10 | 1·94 | | | | | | | | | Garden, .. | 7 | 1·94 | 26·25 | 0·183 | 0·183 |
| 110 | „ .. | 2 | 4 | 2·54 | 18 | 23 | 20·5 | „ .. | „ .. | .. | .. | .. | .. | Barley, .. | 2 | 4·9 | | | | | | | | | Barley, .. | 2·47 | 4·9 | 23 | 0·131 | 0·065 |
| | | | | | | | | | | | | | | Wheat, .. | 3 | 9·9 | 50·7 | 95 | .. | .. | .. | .. | .. | .. | Wheat, .. | 3 | 9·9 | 51 | 0·145 | 0·072 |
| | | | | | | | | | | | | | | Gujai, .. | 3 | 2·1 | | | | | | | | | Gujai, .. | 2·4 | 2·1 | 8·5 | 0·149 | 0·074 |

TABLE A.—*Observation and Experiment*—(Continued).

| Serial Number. | EXPERIMENTAL. WORK. Duration of work minutes. | No. of lifts. | Cubic feet lifted. Per pair of cattle per hour. | Per lift, per hour. | Total per well. | H. P. Per bullock. | Total per well. | Length of watercourse. | Area Irrigated. Crop. | Watering. | Interval. | Area in square feet. | Depth. On area. | Of damp. | Days to an Acre. Per pair of cattle. | Per lift. | Per well. | Duty per pair. | COST. Annual. Interest at 5 p. c. | Repairs, &c. | Total. | Per Acre. Per acre Irrigated. | Lifting. | Total. | Remarks. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 92 | 93 | 94 | 95 | 96 | 97 | 98 | 99 | 100 | 101 | 102 | 103 | 104 | 105 | 106 | 107 | 108 | 109 | 110 | 111 | 112 | 113 | 114 | 115 | 116 |
| 74 | 420 | 342 | 181 | 181 | 1,270 | 1·580 | 663 | 160 | Wheat, .. | 3 | .. | 5,734 | ·2215 | .. | 7·6 | 7·6 | 7·6 | .. | 0·3 | 8·0 | 8·3 | | | | |
| 78 | 510 | 323 | 128 | 128 | 1,089 | 1·125 | 574 | 560 | „ .. | 2 | .. | 6,027 | ·1007 | .. | 7·2 | 7·2 | 7·2 | .. | 0·3 | 8·0 | 8·3 | | | | |
| 80 | .. | .. | .. | .. | .. | .. | .. | .. | „ .. | 2 | .. | 7,822 | .. | .. | 5·6 | 5·6 | 5·6 | .. | 0·4 | 8 0 | 8·4 | | | | |
| 84 | .. | .. | .. | .. | .. | .. | .. | .. | „ .. | 2 | .. | 7,841 | .. | .. | 5·5 | 5·5 | 5·5 | .. | 0·3 | 8·0 | 8·3 | | | | |
| 86 | 320 | 8·59 | .. | 64·8 | 343 | ·447 | 143 | 160 | Garden, .. | x | .. | 3,483 | ·10 | 0·6 | .. | 12·3 | 12·3 | .. | 0·1 | 1·5 | 1·6 | | | | |
| 87 | 444 | 13·11 | .. | 70·8 | 524 | ·524 | 233 | 220 | „ .. | x | .. | 3,783 | ·14 | 0·7 | .. | 11·5 | 11·5 | .. | 0·1 | 1·5 | 1·6 | | | | |
| 88 | 575 | 199 | 120 | 120 | 1,142 | 1·728 | 994 | 400 | Tobacco, .. | x | 5 days, | 8,286 | ·13 | ·73 | 5·27 | 5·27 | 5·27 | .. | 0·3 | 11·6 | 11·3 | | | | |
| 90 | 549 | 351 | 184 | 184 | 1,684 | 2·860 | 1,572 | 300 | „ .. | x | .. | 12,509 | ·13 | ·75 | 3·5 | 3·5 | 3·5 | .. | 0·3 | 10·0 | 10·3 | | | | |
| 92 | 563 | 335 | 137 | 137 | 1,280 | 1·325 | 746 | 250 | „ .. | x | .. | 8,448 | ·13 | ·66 | 5·1 | 5·1 | 5·1 | .. | 0·4 | 10·5 | 10·9 | | | | |
| 94 | 525 | 336 | 176 | 176 | 1,546 | 1·685 | 885 | 400 | „ .. | x | .. | 8,464 | ·18 | ·75 | 5·0 | 5·0 | 5·0 | .. | 0·4 | 10·5 | 10·9 | | | | |
| 96 | 620 | 525 | 72 | 72 | 1,475 | ·411 | 255 | 600 | Gujai, .. | 1 | .. | 9,775 | ·145 | ·50 | 8·9 | 8·9 | 4·4 | .. | 12·8 | 11·0 | 23·8 | | | | |
| 99 | .. | .. | .. | .. | .. | .. | .. | .. | Wheat, .. | 1 | .. | 7,600 | .. | .. | 6·0 | 6·0 | 6·0 | .. | 12·6 | 6·0 | 18·6 | | | | |
| 100 | 480 | 1·172 | 116 | 116 | 3,718 | ·827 | 398 | 1,120 | Wheat & Gram, | 1 | .. | 15,362 | ·24 | ·75 | 11·2 | 11·2 | 2·8 | .. | 20·6 | 25·0 | 45·6 | | | | |
| 106 | 525 | 1,468 | 123 | 123 | 4,294 | ·546 | 287 | 1,060 | Barley, .. / Wheat, .. | 2 / 2 | 20 days, / 20 days, | 33,107 | ·13 | ·75 | 5·2 | 5·2 | 1·3 | .. | 20·6 | 21·0 | 41·6 | | | | |
| 110 | 640 | 2,216 | 66 | 132 | 5,629 | ·400 | 256 | 910 | Wheat, .. | 2 | 30 days, | 23,049 | 0·24 | 0·55 | 1·5 | 7·5 | 1·88 | .. | 13·1 | 17·0 | 30·1 | | | | |

TABLE A.—*Observation and Experiment*—(Continued).

STATISTICAL.

| Serial Number. | Province. | District. | Pergunna. | Village. | Year. | Area in Acres. Actual area in acres. | Percentage uncultivated. Waste. | Culturable. | Cultivated Area. Percentage of actual area cultivated. | Double cropped area in acres. | Total area actually cultivated in the year. | Percentage of Total Cultivated Area. Wet. | Dry. | Kharif. Wet. Wells. | Canals. | Other sources. | Dry. | Total. | Rabi. Wet. Wells. | Canals. | Other sources. | Dry. | Total. | Irrigation Wells. Lime masonry. | Dry bricks. | Kacha. | Total. | Lifts. Leather bucket. | Earthen pots. | Total. | Usual labor for lifting buckets. | Average area per lift, in acres. Kharif. | Rabi. | Total. | Remarks. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 |
| 113 | | | Mainpuri, .. | Hasanpur, .. | 1879-80 | 168·37 | 39·2 | 7·2 | 53·6 | 7.05 | 97·25 | 45·2 | 54·8 | 5·6 | .. | .. | 31·0 | 36·6 | 39·6 | .. | .. | 25·8 | 63·4 | 4 *p*·2 | .. | 1 *p*·1 | 3 | 9 | .. | 9 | .. | 0·60 | 4·28 | 4·88 | All these Wells have splendid springs. |
| 115 | | | „ .. | „ .. | 80-81 | 168·37 | 39·4 | 6·1 | 54·5 | 4·63 | 96·37 | 58·6 | 41·4 | 9·8 | .. | .. | 38·0 | 47·8 | 48·8 | .. | .. | 3·4 | 52·2 | 4 *p*·2 | .. | 1 *p*·1 | 3 | 9 | .. | 9 | .. | 1·05 | 5·22 | 6·27 | „ „ |
| 117 | | | „ .. | Sansarpur, .. | 79-80 | 1142·4 | 30·53 | 10·08 | 59·39 | 54·4 | 733·50 | 41·5 | 58·5 | 6·4 | .. | .. | 47·2 | 53·6 | 35·1 | .. | .. | 11·3 | 46·4 | 25 | .. | 7 | 32 | 51 | 7 | 58 | .. | 0·81 | 4·44 | 5·25 | „ „ |
| 119 | | | „ .. | „ .. | 80-81 | 1142·4 | 30·51 | 11·73 | 57·76 | 64·66 | 723·66 | 54·5 | 45·5 | 15·4 | .. | .. | 39·10 | 54·5 | 39·1 | .. | .. | 6·4 | 45·5 | 27 | .. | 15 | 42 | 45 | 15 | 60 | .. | 1·85 | 4·72 | 6·57 | „ „ |
| 131 | N. W. P. | MAINPURI. | Ghiror, .. | Ghiror, .. | 79-80 | 9100·8 | 38·43 | 4·93 | 56·64 | 292·2 | 1368·8 | 57·82 | 42·18 | 7·95 | 5·26 | 0·16 | 29·84 | 43·21 | 15·91 | 26·97 | 1·57 | 12·34 | 56·79 | 2 *p*·4 1 *p*·16 | .. | 15 | 61 | 81 | 85 | .. | 85 | .. | 1·28 | 2·56 | 3·84 | Village close to Ganges Canal. Note kacha wells. |
| | | | „ .. | „ .. | 80-81 | 1900·8 | 41·67 | 5·87 | 52·46 | 274·97 | 1272·17 | 72·10 | 27·90 | 10·8 | 17·76 | 1·04 | 22·62 | 52.22 | 20.40 | 21·76 | 0·34 | 5·28 | 47·78 | 2 *p*·4 1 *p*·16 | .. | 15 | 66 | 86 | 90 | .. | 90 | .. | 1·52 | 2·88 | 4·40 | |
| 136 | | | Shikohabad, 1st, | Mahirabad, .. | 79-80 | 423·54 | 14·60 | 17·95 | 67·45 | 96·5 | 382·16 | 23·35 | 76·65 | 2·88 | .. | .. | 55·30 | 58·18 | 20.04 | .. | 0·43 | 21·35 | 41·82 | .. | .. | 25 | 25 | 27 | .. | 27 | .. | 0·40 | 2·83 | 3·28 | |
| 138 | | | „ .. | „ .. | 80-81 | 423·54 | 15·14 | 6·24 | 78·62 | 29·0 | 361·94 | 35·79 | 64·21 | 7·22 | .. | 0·36 | 57·06 | 64·64 | 17·26 | 10·95 | .. | 7·15 | 35·36 | .. | .. | 28 | 28 | 28 | .. | 28 | .. | 0·92 | 2·22 | 3·14 | First Year Canal. Note effect. |
| 141 | | | „ .. | Shikohabad, .. | 79-80 | 781·29 | 30·0 | 7·2 | 62·8 | 150·43 | 642·43 | 33·6 | 66·4 | 4·2 | .. | .. | 60·2 | 64·4 | 29·4 | .. | .. | 6·2 | 35·6 | 18 | .. | 58 | 76 | 92 | .. | 92 | .. | 0·30 | 2·04 | 2·34 | |
| 143 | | | „ .. | „ .. | 80-81 | 781·29 | 29·8 | 9·0 | 61·2 | 108·14 | 592·23 | 52·5 | 47·5 | 14·65 | .. | 0·05 | 43·4 | 58·1 | 33·0 | 0·8 | 4·0 | 4·1 | 41·9 | 19 | .. | 67 | 86 | 93 | .. | 93 | .. | 0·95 | 2·15 | 3·10 | |
| 147 | | | „ 2nd, | Mustpur, .. | 79-80 | 398·63 | 12·9 | 28·8 | 58·3 | 0·8 | 233·1 | 42·5 | 57·5 | 0·4 | .. | .. | 48·9 | 49·3 | 42·1 | .. | .. | 8·6 | 50.7 | 2 *p*·1 1 *p*·1 | .. | 25 | 27 | 28 | .. | 28 | .. | 0·03 | 2·45 | 2·48 | |
| | | | „ .. | „ .. | 80-81 | 398·63 | 13·5 | 29·5 | 57·0 | 32·1 | 256·33 | 50·9 | 49·1 | 1·0 | .. | .. | 46·5 | 47·5 | 7·2 | 42·7 | .. | 2·6 | 52·5 | 2 *p*·1 1 *p*·1 | .. | 26 | 28 | 29 | .. | 29 | .. | 0·10 | 0·45 | 0·55 | |

TABLE A.—*Observation and Experiment*—(Continued).

| DESCRIPTIVE. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Serial Number. | *Date.* | | | Number of Well. | *Class.* | *Cost.* | | | | | | | *Supply.* | *Quality.* | *Substratum.* | *Cultivators on well.* | | *Labor and cost per day in annas.* | | | | | | | | | | | | | | |
| | Day. | Month. | Year. | | | Construction. | Fittings. | Total. | Renewal. | Lifts. | Yearly repairs. | Total. | | | | Number. | Caste. | Men, home. | Do. hired. | Rate, per day. | Cattle. | Cost for men. | Do. for cattle. | Total cost, per day. | | | | | | | | |
| 37 | 38 | 39 | 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 | 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 | 61 | | | | | | | | |
| 113 | 16 | 1 | 82 | 109 | Masonry, .. | 250/- | 10/- | 260/- | .. | 5/- | 1/- | 16/- | Spring, .. | Sweet, .. | Clay, .. | 4 Brahmin, 3 Chamar, 1 Kachi, 1 Herdsman, | | 6 | 1 | 1·5 | 6 | 6·5 | 9 | -/15/6 | | | | | | | | |
| 117 | 17 | 1 | 82 | 519 | „ .. | 250/- | 12/- | 262/- | .. | 6/- | 1/- | 25/- | „ .. | „ .. | „ .. | 12 Brahmin, 1 Ahir, | | 5 | 4 | 1·5 | 9 | 10 | 13·5 | 1/7/6 | | | | | | | | |
| 120 | 18 | 1 | 82 | 511 | „ .. | 150/- | 6/- | 156/- | .. | 5/- | 3/- | 13/- | „ .. | „ .. | „ .. | 7 Brahmin, .. | | 3 | 2 | 1·5 | 4 | 5 | 6 | -/11/- | | | | | | | | |
| 123 | 18 | 1 | 82 | 701 | „ .. | 200/- | 6/- | 206/- | .. | 5/- | 3/- | 13/- | „ .. | „ .. | „ .. | 12 Brahmin, .. | | 4 | 1 | 1·5 | 6 | 4·5 | 9 | -/13/6 | | | | | | | | |
| 128 | 18 | 1 | 82 | 1,016 | „ .. | 250/- | 12/- | 262/- | .. | 5/- | 1/- | 21/- | „ .. | „ .. | „ .. | 6 Brahmin, 1 Chamar, 1 Kachi, | | 2 | 5 | 1·5 | 6 | 8·5 | 9 | 1/1/6 | | | | | | | | |
| 131 | 19 | 1 | 82 | 2,069 | „ .. | 100/- | 3/- | 103/- | .. | 7/- | 1/- | 8/- | Percolation, | „ .. | Sand, | 1 Lodha, 3 Kachi, | | 3 | .. | .. | 2 | 2 | 3 | -/5/- | | | | | | | | |
| 133 | 19 | 1 | 82 | 2,070 | „ .. | 100/- | 3/- | 103/- | .. | 6/- | 1/- | 7/- | .. | .. | .. | 2 Chamar, 1 Kachi, 1 Lodha, | | 2 | 1 | 1·5 | 2 | 2·5 | 3 | -/5/6 | | | | | | | | |
| 136 | 21 | 1 | 82 | 183 | Kucha lined, .. | 4/- | 2/- | 6/- | 4/- | 7/- | .. | 11/- | „ .. | „ .. | Clay, .. | 1 Lodha, .. | | 2 | 1 | 1·5 | 2 | 2·5 | 3 | -/5/6 | | | | | | | | |
| 138 | 21 | 1 | 82 | 125 | „ „ .. | 4/- | 2/- | 6/- | 4/- | 7/- | .. | 11/- | „ .. | „ .. | „ .. | 1 Lodha, .. | | 1 | 2 | 1·5 | 2 | 4 | 3 | -/7/- | | | | | | | | |
| 140 | 21 | 1 | 82 | 127 | „ „ .. | 4/- | 2/- | 6/- | 4/- | 7/- | .. | 11/- | „ .. | „ .. | „ .. | 1 Lodha, .. | | 2 | 1 | 1·5 | 2 | 2·5 | 3 | -/5/6 | | | | | | | | |
| 141 | 22 | 1 | 82 | 514 | „ „ .. | 7/- | 2/- | 9/- | 4/- | 7/- | .. | 11/- | Spring, .. | „ .. | „ .. | 1 Lodha, 1 Ahir, | | 1 | 2 | 1·5 | 2 | 3 | 3 | -/6/- | | | | | | | | |
| 143 | 22 | 1 | 82 | 683 | Masonry, .. | 150/- | 6/- | 156/- | .. | 7/- | 1/- | 15/- | „ .. | „ .. | „ .. | 1 Lodha, .. | | 1 | 2 | 1·5 | 4 | 3 | 6 | -/9/- | | | | | | | | |
| 147 | 23 | 1 | 82 | 261 | Kucha lined, .. | 7/- | 3/- | 10/- | 3/- | 6/- | .. | 9/- | Percolation, | „ .. | Sand, .. | 1 Ahir, .. | | 3 | .. | .. | 2 | 2 | 3 | -/5/- | | | | | | | | |

TABLE A.—*Observation and Experiment*—(Continued).

| Serial Number. | EXPERIMENTAL. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | *Run.* | | *Lift.* | | *Depth to Wells.* | | | Soil. | COMMAND. | | | | | | | | | | AREA IRRIGATED TO DATE. | | | | | | | | | | | |
| | | | | | | | | | *Kharif* 1881-82. | | | | | *Rabi* 1881-82. | | | | | *Kharif* 1881-82. | | | | | | *Rabi* 1881-82. | | | | | |
| | Class. | Pairs of cattle to each lift. | Number. | Content in cubic feet. | Morning. | Evening. | Mean. | | Crop. | Waterings required. | Area. | Total area reduced to one watering. | No. of days to area. | Crop. | Waterings required. | Area. | Total area reduced to one watering. | No. of days to area. | Crop. | Waterings given. | Area. | Working days to date. | Duty. Per lift. | Duty. Per pair. | Crop. | Waterings given. | Area. | Working days to date. | Duty. Per lift. | Duty. Per pair. |
| | 62 | 63 | 64 | 65 | 66 | 67 | 68 | 69 | 70 | 71 | 72 | 73 | 74 | 75 | 76 | 77 | 78 | 79 | 80 | 81 | 82 | 83 | 84 | 85 | 86 | 87 | 88 | 89 | 90 | 91 |
| 113 | Lagor, .. | 1 | 3 | 2·7 | 16·6 | 18 | 17·3 | Dumat, .. | Sugarcane,.. | .. | .. | .. | .. | Gujai, .. | 3 | 13·0 | 52·12 | 151 | .. | .. | .. | .. | .. | .. | Gujai, .. | 2 | 13·0 | 55 | 0·151 | 0·151 |
| | | | | | | | | | | | | | | Wheat, .. | 3 | 3·4 | | | | | | | | | Wheat, .. | 3 | 3·14 | 18 | 0·174 | 0·174 |
| | | | | | | | | | | | | | | Garden, .. | 10 | 0·37 | | | | | | | | | Garden, .. | 5 | 0·37 | 5 | 0·123 | 0·123 |
| 117 | „ .. | 1·125 | 4 | 3·15 | 18 | 20 | 19 | „ .. | „ .. | .. | 2·8 | .. | .. | Barley, .. | 2 | 3·23 | 50·08 | 100 | .. | 2 | 2·8 | .. | .. | .. | Barley, .. | 2 | 3·23 | 16·5 | 0·100 | 0·088 |
| | | | | | | | | | | | | | | Gujai, .. | 3 | 3·11 | | | | | | | | | Gujai, .. | 2 | 3·11 | 16 | 0·100 | 0·088 |
| | | | | | | | | | | | | | | Wheat, .. | 3 | 11·43 | | | | | | | | | Wheat, .. | 2 | 11·43 | 56·5 | 0·100 | 0·088 |
| 120 | „ .. | 1 | 2 | 2·95 | 17 | 20·5 | 18·75 | „ .. | „ .. | 4 | 3·17 | 12·68 | 38 | Barley, .. | 2 | 2·51 | 15·46 | 46 | .. | 1·5 | 2·8 | 12 | 0·175 | 0·175 | Barley, .. | 1·7 | 2·51 | 14·0 | 0·152 | 0·152 |
| | | | | | | | | | | | | | | Gujai, .. | 3 | 1·23 | | | | | | | | | Gujai, .. | 1 | 1·23 | 5 | 0·123 | 0·123 |
| | | | | | | | | | | | | | | Wheat, .. | 3 | 2·25 | | | | | | | | | Wheat, .. | 1·8 | 2·25 | 14·5 | 0·140 | 0·140 |
| 123 | „ .. | 1·5 | 2 | 3·015 | 16 | 26 | 21 | „ .. | „ .. | 4 | 1·8 | 7·2 | .. | Gujai, .. | 3 | 1·97 | 39·30 | 86 | .. | 2 | 1·8 | 14 | 0·130 | 0·09 | Gujai, .. | 2 | 1·97 | 13·0 | 0·150 | 0·100 |
| | | | | | | | | | | | | | | Gram, .. | 2 | 0·40 | | | | | | | | | Gram, .. | 2 | 0·40 | 2·0 | 0·200 | 0·133 |
| | | | | | | | | | | | | | | Carrots, .. | 10 | 0·77 | | | | | | | | | Carrots, .. | 5·7 | 0·77 | 13 0 | 0·160 | 0·112 |
| | | | | | | | | | | | | | | Wheat, .. | 3 | 4 70 | | | | | | | | | Wheat, .. | 1·7 | 4·70 | 28·0 | 0 142 | 0·095 |
| | | | | | | | | | | | | | | Parley, .. | 2 | 5·40 | | | | | | | | | Barley, .. | 1·5 | 5·40 | 24·0 | 0·170 | 0·113 |
| 128 | „ (44 ft.) | 1 | 18-1-82 3 | 3·094 | 16 | 18 | 17 | „ .. | „ .. | .. | .. | .. | .. | Barley, .. | 2 | 2·77 | 45·74 | 102 | .. | .. | .. | .. | .. | .. | Barley, .. | 2 | 2·77 | 13·0 | 0·142 | 0·142 |
| | | | | | | | | | | | | | | Wheat, .. | 3 | 10·29 | | | | | | | | | Wheat, .. | 3 | 10·29 | 72·0 | 0·142 | 0·142 |
| | | | | | | | | | | | | | | Gujai, .. | 3 | 3 11 | | | | | | | | | Gujai, .. | 3 | 3·11 | 15·0 | 0·207 | 0 207 |
| 131 | „ .. | 1 | 1 | 4·05 | 10·4 | 17 | 13·7 | Matyar, .. | „ .. | .. | .. | .. | .. | Tobacco, .. | 12 | 0 91 | 24·3 | 131 | .. | .. | .. | .. | .. | .. | Tobacco, .. | 10 | 0·91 | 30·0 | 0·303 | 0·303 |
| | | | | | | | | | | | | | | Wheat, .. | 3 | 4·46 | | | | | | | | | Wheat, .. | 2 | 4·46 | 38·0 | 0·234 | 0·234 |
| 133 | „ .. | 1 | 1 | 3·49 | 9 | 12 | 10·5 | Dumat, .. | „ .. | .. | .. | .. | .. | Parley, .. | 2 | 1·50 | 13·18 | 76 | .. | .. | .. | .. | .. | .. | Barley, .. | 1 | 1·50 | 9 | 0·166 | 0·166 |
| | | | | | | | | | | | | | | Wheat, .. | 3 | 1·86 | | | | | | | | | Wheat, .. | 2 | 1·86 | 16 | 0·232 | 0·232 |
| | | | | | | | | | | | | | | Opium, .. | 10 | 0·46 | | | | | | | | | Opium, .. | 3 | 0·46 | 3 | 0·460 | 0·460 |
| 136 | „ .. | 1 | 1 | 4·05 | 12 | 18 | 15 | Sandy, .. | „ .. | .. | .. | .. | .. | Wheat, .. | 3 | 2·98 | 11·18 | 89 | .. | .. | .. | .. | .. | .. | Wheat, .. | ·357 | 2·98 | 8·5 | 0·124 | 0·124 |
| | | | | | | | | | | | | | | Barley, .. | 2 | 1·12 | | | | | | | | | Barley, .. | .. | 1·12 | .. | .. | .. |
| 138 | „ .. | 1 | 1 | 4·106 | 13 | 21 | 17 | Dumat, .. / Sandy, .. | „ .. | .. | .. | .. | .. | Wheat, .. | 3 | 5·31 | 17·43 | 68 | .. | .. | .. | .. | .. | .. | Wheat, .. | 1·53 | 5·31 | 55 | 0·147 | 0·147 |
| | | | | | | | | | | | | | | Garden, .. | 10 | 0·15 | | | | | | | | | Garden, .. | 5 | 0·15 | 2·5 | 0·300 | 0·300 |
| 140 | „ .. | 1 | 1 | 4·16 | 13 | 23 | 18 | Dumat, .. | „ .. | .. | .. | .. | .. | Wheat, .. | 3 | 4·4 | 13·2 | 42 | .. | .. | .. | .. | .. | .. | Wheat, .. | 1·2 | 4·4 | 38 | 0·165 | 0·165 |
| 141 | | 1 | 1 | 4·05 | 14·5 | 19 | 16·75 | „ .. | „ .. | .. | .. | .. | .. | Wheat, .. | 3 | 4·1 | 12·3 | 73 | .. | .. | .. | .. | .. | .. | Wheat, .. | 1·11 | 4·1 | 30·5 | 0·150 | 0·150 |
| | | | | | | | | | | | | | | Barley, .. | 2 | 1·9 | | | | | | | | | Barley, .. | 1 | 1·9 | 11 | 0·090 | 0·090 |
| 143 | „ .. | 1 | 2 | 4·725 | 17 | 24·5 | 20·75 | „ .. | „ .. | .. | .. | .. | .. | Wheat, .. | 3 | 3·17 | 33 | 125 | .. | .. | .. | .. | .. | .. | Wheat, .. | ·37 | 3·17 | 6 | 0·100 | 0·100 |
| | | | | | | | | | | | | | | Potatoes, .. | 10 | 1·3 | | | | | | | | | Potatoes, .. | 9 | 1·3 | 54 | 0·108 | 0·108 |
| | | | | | | | | | | | | | | Carrots, .. | 10 | 0·7 | | | | | | | | | Carrots, .. | 9 | 0·7 | 27 | 0·117 | 0·117 |
| | | | | | | | | | | | | | | Barley, .. | 2 | 0·37 | | | | | | | | | Barley, .. | 1 | 0·37 | 3 | 0·123 | 0·123 |
| 147 | „ .. | 1 | 1 | 3·4875 | 21·5 | 29 | 25·25 | „ .. | Failed, .. | .. | .. | .. | .. | Gujai, .. | 3 | 1·74 | 10·52 | 84 | .. | .. | .. | .. | .. | .. | Gujai, .. | 1 | 1·74 | 18 | 0·096 | 0·096 |
| | | | | | | | | | | | | | | Wheat, .. | 4 | 1·14 | | | | | | | | | Wheat, .. | 1 | 1·14 | 12 | 0·095 | 0·095 |

TABLE A.—*Observation and Experiment*—(Continued).

| Serial Number. | EXPERIMENTAL. WORK. Duration of work minutes. | No. of lifts. | Cubic feet lifted. Per pair of cattle per hour. | Per lift, per hour. | Total per well. | H. P. Per bullock. | Total per well. | Length of watercourse. | Area Irrigated. Crop. | Watering. | Interval. | Area in square feet. | Depth. On area. | Of damp. | Days to an Acre. Per pair of cattle. | Per lift. | Per well. | Duty per pair. | COST. Annual. Interest at 5 p. c. | Repairs, &c. | Total. | Per Acre. Per acre Irrigated. | Lifting. | Total. | Remarks. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 92 | 93 | 94 | 95 | 96 | 97 | 98 | 99 | 100 | 101 | 102 | 103 | 104 | 105 | 106 | 107 | 108 | 109 | 110 | 111 | 112 | 113 | 114 | 115 | 116 |
| 113 | 545 | 1,303 | 129 | 129 | 3,518 | ·605 | 330 | 1,280 | Gujai, .. | 2 | 45 days, | 14,904 | ·236 | ·66 | 8·8 | 8·8 | 2·9 | .. | 13·0 | 16·0 | 29·0 | .. | .. | .. | |
| 117 | 600 | 2,111 | 147 | 166 | 6,650 | ·771 | 463 | 1,710 | Barley, .. | 2 | 30 days, | 22,000 | ·37 | ·75 | 9·0 | 8·0 | 2·0 | .. | 13·1 | 25·0 | 38·1 | .. | .. | .. | |
| 120 | 595 | 1,112 | 166 | 166 | 3,280 | ·892 | 531 | 370 | Barley, .. | 2 | 45 days, | 14,330 | ·228 | ·80 | 6·0 | 6·0 | 3·0 | .. | 7·8 | 13·0 | 20·8 | .. | .. | .. | |
| 123 | 630 | 1,195 | 114 | 171 | 3,603 | ·787 | 496 | 870 Carrots, .. / 870 Wheat, .. / 550 .. | 5 / 2 / 2 | x / 30 days, / .. | 3,332 / 5,130. / 6,900. | ·234 | ·75 | 6·5 | 4·3 | 2·18 | .. | 10 3 | 13 0 | 23·3 | .. | .. | .. | |
| 128 | 520 | 1,095 | 130 | 130 | 3,388 | ·612 | 318 | 1,050 | Wheat, .. | 3 | 45 days, | 19,434 | ·174 | ·75 | 6·72 | 6·72 | 2·24 | .. | 13·1 | 21·0 | 34·1 | .. | .. | .. | |
| 131 | 550 | 620 | 274 | 274 | 2,511 | 1·200 | 660 | 370 | Wheat, .. | 2 | 60 days, | 8,027 | ·31 | 1·0 | 5·4 | 5·4 | 5·4 | .. | 5·1 | 8·0 | 13·1 | .. | .. | .. | |
| 133 | 530 | 458 | 184 | 184 | 1,598 | ·556 | 295 | 680 | Wheat, .. | 2 | 30 days, | 7,509 | ·226 | ·75 | 5·8 | 5·8 | 5·8 | .. | 5·1 | 7·0 | 12·1 | .. | .. | .. | |
| 136 | 376 | 291 | 187 | 187 | 1,178 | ·873 | 328 | 450 | Wheat, .. | 1 | .. | 4,890 | ·24 | ·80 | 8·0 | 8·0 | 8·0 | .. | 0·3 | 11·0 | 11·3 | .. | .. | .. | |
| 138 | 522 | 540 | 255 | 255 | 2,217 | 1·380 | 720 | 370 | Wheat, .. | 2 | 37 days, | 11,322 | ·195 | ·66 | 3·9 | 3·9 | 3·9 | .. | 0·3 | 11·0 | 11·3 | .. | .. | .. | |
| 140 | 530 | 465 | 222 | 222 | 1,934 | 1·302 | 690 | 340 | Wheat, .. | 2 | 45 days, | 13,450 | ·144 | ·5 | 3·2 | 3·2 | 3·2 | .. | 0·3 | 11·0 | 11·3 | .. | .. | .. | |
| 141 | 398 | 297 | 182 | 182 | 1,203 | 0·900 | 355 | 240 | Wheat, .. | 2 | 30 days, | 7,240 | ·163 | ·5 | 6·0 | 6·0 | 6·0 | .. | 0·5 | 11·0 | 11·5 | .. | .. | .. | |
| 143 | 360 | 563 | 222 | 222 | 2,660 | 1·388 | 500 | 560 | Wheat, Barley, | 1 | .. | 11,400 | ·233 | ·8 | 7·6 | 7·6 | 3·8 | .. | 7·8 | 15·0 | 22·8 | .. | .. | .. | |
| 147 | 440 | 308 | 146 | 146 | 1,074 | 1·107 | 487 | 180 | Wheat, .. | 2 | 30 days, | 5,332 | ·194 | ·8 | 8 | 8 | 8 | .. | 0·5 | 9·0 | 9·5 | .. | .. | .. | |

TABLE A.—*Observation and Experiment*—(Continued).

| Serial Number. | Province. | District. | Pergunna. | Village. | Year. | Area in Acres. | | | Cultivated Area. | | | Percentage of Total Cultivated Area. | | | | | | | | | | | Irrigation Wells. | | | | Lifts. | | | Usual labor for lifting buckets. | Average area per lift, in acres. | | | Remarks. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Actual area in acres. | Percentage uncultivated. | | Percentage of actual area cultivated. | Double cropped area in acres. | Total area actually cultivated in the year. | Kharif. | | | | | Rabi. | | | | | | Lime masonry. | Dry bricks. | Kacha. | Total. | Leather bucket. | Earthen pots. | Total. | | Kharif. | Rabi. | Total. | |
| | | | | | | | Waste. | Culturable. | | | | Wet. | | | | | Wet. | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | Wet. | Dry. | Wells. | Canals. | Other sources. | Dry. | Total. | Wells. | Canals. | Other sources. | Dry. | Total. | | | | | | | | | |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 |
| | | | Shikohabad,... | Mustpur,(*contd*) | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | |
| 155 | | | „ ... | Ekka, ... (Chamnagar,) | 1879-80 | 8460·3 | 39·6 | 9·8 | 50·60 | 9·35 | 5214·1 | 49·43 | 50·57 | 5·59 | 0·20 | 0·04 | 46·05 | 51·88 | 42·90 | 0·66 | 0·04 | 4·52 | 48·12 | 8 *p*-1<br>6 *p*-10<br>4 *p*-79 | 2 *p*-85 | 2 *p*-17<br>1 *p*-45 | 237 | 633 | ... | 633 | Bullock, | 0·46 | 3·54 | 4·00 | Splendid springs W.S. raised 5′ to 6′ by Canal. |
| | | | „ ... | „ ... | 80-81 | 8460·3 | 39·4 | 11·4 | 49·20 | 94·98 | 5103·8 | 74·29 | 25·71 | 26·65 | 0·35 | 3·12 | 22·20 | 52·32 | 42·67 | 1·46 | 0·04 | 3·51 | 47·68 | 8 *p*-1<br>6 *p*-10<br>4 *p*-79 | 2 *p*-87<br>... | 2 *p*-17<br>1 *p*-47 | 241 | 639 | ... | 639 | „ | 2·13 | 3·40 | 5·53 | |
| 166 | W. P. | N. | „ ... | Gopalpur, ... | 79-80 | 1188·5 | 58·80 | 5·37 | 35·83 | 24·86 | 450·72 | 17·25 | 82·75 | 0·70 | ... | 0·34 | 43·80 | 44·84 | 7·41 | 8·70 | 0·10 | 38·95 | 55·16 | 4 *p*-1<br>2 *p*-9 | ... | 2 *p*-4 | | | | | | | | |
| | | | „ ... | ... | 80-81 | 1188·5 | 59·50 | 7·14 | 33·36 | 38·71 | 435·08 | 47·67 | 52·33 | 8·20 | 0·93 | 0·72 | 30·70 | 40·55 | 28·13 | 8·58 | 1·11 | 21·63 | 59·40 | 1 *p*-2<br>4 *p*-1<br>2 *p*-9<br>1 *p*-2 | ... | 1 *p*-1<br>2 *p*-4<br>1 *p*-3 | 17<br>19 | 33<br>35 | ...<br>... | 33<br>35 | „<br>„ | 0·10<br>1·01 | 1·01<br>2·44 | 1·11<br>3·45 | W. S. raised 6′ by Canals. |
| 173 | | | „ ... | Ooresur, ... (Gurra Muzra,) | 79-80<br>80-81 | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | .. | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | |
| 178 | | | Etah Sukhet, | Chachena, ... | 79-80 | 272·4 | 14·2 | 15·8 | 70·0 | ... | 190·9 | 42·74 | 57·26 | ... | 22·27 | 0·07 | 50·20 | 72·54 | 0·89 | 19·33 | 0·18 | 7·06 | 27·46 | ... | 2 | ... | 2 | 3 | ... | 3 | „ | ... | 0·6 | 0·06 | 17 Wells not used on account of Canal. |
| | | | | | 80-81 | 272·4 | 14·2 | 16·8 | 69·0 | ... | 188·4 | 47·59 | 52·41 | 0·57 | 18·42 | ... | 51·68 | 70·67 | 0·72 | 27·88 | ... | 0·73 | 29·33 | ... | 2 | ... | 2 | 3 | ... | 3 | „ | ·36 | 0·45 | 1·81 | |
| 180 | | ETAH. | „ ... | Mubarikpur,... | 79-80 | 380·0 | 38·3 | 13·2 | 48·5 | ... | 184·0 | 27·1 | 72·4 | 0·3 | 3·6 | ... | 56·5 | 60·4 | 20·2 | 3·0 | ... | 16·4 | 39·6 | ... | 4 *p*-2<br>2 *p*-4 | 2 *p*-5<br>1 *p*-3 | 15 | 30 | ... | 30 | „ | ·02 | 1·24 | 1·26 | |
| | | | | | 80-81 | 380·0 | 38·2 | 13·6 | 48·2 | ... | 182·8 | 23·11 | 76·89 | 2·38 | 2·33 | ... | 65·94 | 70·65 | 13·45 | 4·95 | ... | 10·95 | 29·25 | ... | 1 *p*-1 | ... | 15 | 30 | ... | 30 | „ | ·14 | 0·81 | 0·95 | |

TABLE A.—*Observation and Experiment*—(Continued).

| DESCRIPTIVE. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Serial Number. | *Date.* | | | Number of Well. | *Class.* | *Cost.* | | | | | | | *Supply.* | *Quality.* | *Substratum.* | *Cultivators on well.* | | *Labor and cost per day in annas.* | | | | | | | | | | | | |
| | Day. | Month. | Year. | | | Construction. | Fittings. | Total. | Renewal. | Lifts. | Yearly repairs. | Total. | | | | Number. | Caste. | Men, home. | Do. hired. | Rate, per day. | Cattle. | Cost for men. | Do. for cattle. | Total cost, per day. | | | | | | |
| 37 | 38 | 39 | 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 | 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 | 61 | | | | | | |
| 150 | 23 | 1 | 82 | 292 | Masonry, ... | 200/- | 3/- | 203/- | ... | 8/- | 1/- | 9/- | Spring, ... | Sweet, ... | Clay, ... | 1 | Ahir, ... | 2 | 2 | 1·5 | 6 | 4 | 9 | -/13/- | | | | | | |
| 153 | 23 | 1 | 82 | 106 | „ ... | 300/- | 6/- | 306/- | ... | 7/- | 1/- | 15/- | „ ... | „ ... | „ 60', ... | 3 | „ ... | 4 | 1 | 1·5 | 9 | 4·5 | 13·5 | 1/2/- | | | | | | |
| 155 | 24 | 1 | 82 | 4,248 | Dry brick, ... | 200/- | 10/- | 210/- | ... | 6/- | 1/- | 25/- | „ ... | „ ... | „ 30', ... | 1 | „ ... | 3 | 4 | 1·5 | 8 | 8 | 12 | 1/4/- | | | | | | |
| 160 | 24 | 1 | 82 | 4,247 | „ „ ... | 200/- | 15/- | 215/- | ... | 5/- | 1/- | 31/- | „ ... | „ ... | „ | 4<br>2<br>1<br>1 | Kachi,<br>Ahir,<br>Brahmin,<br>Chamar, | 4 | 3 | 1·5 | 13 | 7·5 | 19·5 | 1/11/- | | | | | | |
| 166 | 25 | 1 | 82 | 220 | Kucha lined with wood below,.. | 30/- | 4/- | 136/- | ... | 6/- | 1/- | 30/- | „ ... | „ ... | Clay, 32', ... | 11 | Herdsmen, | 2 | 3 | 1·5 | 4 | 5·5 | 6 | -/11/6 | | | | | | |
| 167 | 26 | 1 | 82 | ... | | 30/- | 4/- | | | 6/- | 1/- | | „ ... | „ ... | | | | | | | | | | | | | | | | |
| | ... | ... | ... | ... | | 30/- | 4/- | | | 6/- | 2/- | | „ ... | „ ... | | | | 6 | 3 | 1·5 | 14 | 9·5 | 21 | 1/14/6 | | | | | | |
| | ... | ... | ... | ... | | 30/- | 4/- | | | 6/- | 2/- | | „ ... | „ ... | | | | | | | | | | | | | | | | |
| 170 | 25 | 1 | 82 | 341 | Masonry, ... | 200/- | 6/- | 206/- | ... | 6/- | 1/- | 13/- | „ ... | „ ... | „ | 2<br>5<br>1 | „<br>Ahir,<br>Thakur, | 2 | 2 | 1·5 | 4 | 4 | 6 | -/10/- | | | | | | |
| 173 | 26 | 1 | 82 | 105 | Dry brick, ... | 150/- | 12/- | 162/- | ... | 5/- | 2/- | 22/- | Percolation, | „ ... | „ ... | 8 | Herdsmen, ... | 6 | ... | ... | 8 | 5 | 12 | 1/1/- | | | | | | |
| 178 | 27 | 1 | 82 | 284 | Masonry, ... | 150/- | 6/- | 362/- | ... | 5/- | 2/- | 17/- | Spring, ... | „ ... | Clay, 45', ... | 7 | Ahir, ... | 5 | 1 | 1·5 | 6 | 5·5 | 9 | -/14/6 | | | | | | |
| | | | | | „ ... | 200/- | 6/- | | | | | | | | | 1 | Brahmin, | | | | | | | | | | | | | |
| 180 | 27 | 1 | 82 | 29 | „ ... | 100/- | 6/- | 106/- | ... | 5/- | 1/- | 11/- | „ ... | „ ... | | 1<br>7 | Kachi,<br>Ahir, | 2 | 2 | 1·5 | 4 | 4 | 6 | -/10/- | | | | | | |
| 183 | 27 | 1 | 82 | 33 | „ ... | 100/- | 6/- | 106/- | ... | 5/- | 1/- | 11/- | „ ... | „ ... | „ | 1<br>13<br>1 | Kachi,<br>Ahir,<br>Carpenter, | 2 | 1 | 1·5 | 4 | 2·5 | 6 | -/8/6 | | | | | | |

TABLE A.—*Observation and Experiment*—(Continued).

| Serial Number. | EXPERIMENTAL. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | COMMAND. | | | | | | | | | | | | AREA IRRIGATED TO DATE. | | | | | | | | | | | |
| | *Run.* | | *Lift.* | | *Depth to Wells* | | | | *Kharif* 1881-82. | | | | | *Rabi* 1881-82. | | | | | *Kharif* 1881-82. | | | | | | *Rabi* 1881-82. | | | | | |
| | Class. | Pairs of cattle to each lift. | Number. | Content in cubic feet. | Morning. | Evening. | Mean. | Soil. | Crop. | Waterings required. | Area. | Total area reduced to one watering. | No. of days to area. | Crop. | Waterings required. | Area. | Total area reduced to one watering. | No. of days to area. | Crop. | Waterings given. | Area. | Working days to date. | *Duty.* Per lift. | *Duty.* Per pair. | Crop. | Waterings given. | Area. | Working days to date. | *Duty.* Per lift. | *Duty.* Per pair. | | |
| | 62 | 63 | 64 | 65 | 66 | 67 | 68 | 69 | 70 | 71 | 72 | 73 | 74 | 75 | 76 | 77 | 78 | 79 | 80 | 81 | 82 | 83 | 84 | 85 | 86 | 87 | 88 | 89 | 90 | 91 | | |
| 150 | Kili, ... | 3 | 1 | 5·2875 | 21 | 28 | 24·5 | Matyar, ... | Failed, .. | ... | ... | ... | ... | Barley, ... | 2 | 5·77 | 29·25 | 126 | Sugarcane, ... | ... | ... | ... | ... | ... | Barley, ... | 1 | 5·77 | 25 | 0·230 | 0·073 | | |
| | | | | | | | | | | | | | | Wheat, ... | 3 | 4·57 | | | | | | | | | Wheat, ... | 2 | 4·57 | 36 | 0·254 | 0·085 | | |
| | | | | | | | | | | | | | | Carrots, ... | 10 | 0·4 | | | | | | | | | Carrots, ... | 3 | 0·4 | 45 | 0·266 | 0·089 | | |
| 153 | „ .. | 2·25 | 2 | 4·67 | 16·6 | 31 | 23·8 | Dumat, ... | „ .. | ... | ... | ... | ... | Wheat, ... | 3 | 12·08 | 49·50 | 114 | „ ... | ... | ... | ... | ... | ... | Wheat, ... | 1·7 | 12·08 | 42 | 0·244 | 0·109 | | |
| | | | | | | | | | | | | | | Barley, ... | 2 | 6·63 | | | | | | | | | Barley, ... | 1 | 6·63 | 15 | 0·221 | 0·100 | | |
| | | | | | | | | | | | | | | Gram, ... | 1 | 2·86 | | | | | | | | | Gram, ... | 1 | 2·86 | 6 | 0·219 | 0·219 | | |
| | | | | | | | | | | | | | | Barley, ... | 3 | 1·18 | | | | | | | | | Barley, ... | 2 | 1·18 | 4 | 0·147 | 0·147 | | |
| 155 | Lagor, .. | 1 | 4 | 3·375 | 10 | 17 | 13·5 | „ ... | „ .. | ... | ... | ... | ... | Wheat, .. | 4 | 8·14 | 63·0 | 113 | „ ... | ... | ... | ... | ... | ... | Wheat, ... | 2 | 8·14 | 42 | 0·097 | 0·097 | | |
| | | | | | | | | | | | | | | Gujai, ... | 4 | 2·03 | | | | | | | | | Gujai, .. | 2 | 2·03 | 12 | 0·085 | 0·085 | | |
| | | | | | | | | | | | | | | Guchana, ... | 3 | 5·3 | | | | | | | | | Guchana, ... | 2 | 5·30 | 25 | 0·106 | 0·106 | | |
| | | | | | | | | | | | | | | Gram, ... | 1 | 2·5 | | | | | | | | | Gram, | 1 | 2·5 | 3 | 0·139 | 0·136 | | |
| | | | | | | | | | | | | | | Barley, ... | 3 | 11·14 | | | | | | | | | Barley, | 1·8 | 11·14 | 27 | 0·124 | 0·121 | | |
| 160 | „ .. | 1·017 | 6 | 2·78325 | 10 | 16 | 13·2 | „ ... | Sugarcane, | 4 | 1·46 | 5·84 | ... | Wheat, ... | 4 | 6·23 | 96·57 | 135 | „ ... | 4 | 1·46 | 8 | 0·121 | 0·119 | Wheat, | 2 | 6·23 | 25 | 0·083 | 0·081 | | |
| | | | | | | | | | | | | | | Gujai, ... | 4 | 1·68 | | | | | | | | | Gujai, | 2 | 1·68 | 55 | 0·102 | 0·100 | | |
| | | | | | | | | | | | | | | Guchana, ... | 3 | 3·47 | | | | | | | | | Guchana, | 0·34 | 3·47 | 2 | 0·096 | 0·096 | | |
| | | | | | | | | | | | | | | Opium, ... | 10 | 1·86 | | | | | | | | | Opium, | 4 | 1·86 | 12 | 0·124 | 0·121 | | |
| 166 | „ ... | 1 | 2 | 3·2625 | 9 | 15 | 12 | Mixed, ... | „ ... | ... | ... | ... | ... | Barley, ... | 3 | 3·66 | 120 | 180 | „ ... | ... | ... | ... | ... | ... | Barley, ... | 1·5 | 3·66 | 8 | 0·086 | 0·084 | | |
| | | | | | | | | | | | | | | Gujai, .. | 4 | 3·50 | | | | | | | | | Gujai, ... | 1·5 | 3·5 | 7·5 | 0·081 | 0·080 | | |
| 167 | „ ... | 1·17 | 6 | 3·2715 | 9 | 15 | 12 | „ .. | „ ... | ... | ... | ... | ... | Wheat, ... | 4 | 2·03 | | | | | | | | | Wheat, ... | 1·7 | 20·3 | 5·6 | 0·077 | 0·075 | | |
| | | | | | | | | | | | | | | Carrots, ... | 10 | 1·37 | | | | | | | | | Carrots, ... | 2 | 1·37 | 3 | 0·144 | 0·142 | | |
| | | | | | | | | | | | | | | Barley, ... | 3 | 3·30 | 39·3 | 207 | | | | | | | Barley, ... | 2 | 3·30 | 26 | 0·127 | 0·127 | | |
| 170 | „ ... | 1 | 2 | 3·262 | 11 | 12·3 | 11·65 | Dumat, .. | „ ... | ... | ... | ... | ... | Wheat, .. | 4 | 6·00 | | | „ .. | ... | .. | ... | ... | ... | Wheat, ... | 2·5 | 6·00 | 69 | 0·109 | 0·109 | | |
| | | | | | | | | | | | | | | Carrots, ... | 10 | 0·54 | | | | | | | | | Carrots, ... | 4 | 0·54 | 6 | 0·180 | 0·180 | | |
| | | | | | | | | | | | | | | Gram, ... | 1 | 0·17 | | | | | | | | | Gram, ... | 1 | 0·17 | 0·5 | 0·085 | ·085 | | |
| | | | | | | | | | | | | | | Barley, ... | 2 | 7·70 | | | | | | | | | Barley, ... | 1·5 | 7·70 | 25·5 | 0·113 | ·113 | | |
| 178 | „ ... | 1 | 4 | 2·70 | 15 | 22 | 18·5 | Matyar, ... | „ ... | ... | ... | ... | ... | Gujai, ... | 3 | 0·45 | 38·8 | 160 | „ .. | ... | ... | ... | ... | ... | Gujai, ... | 2 | 0·45 | 2·5 | 0·086 | ·86 | | |
| | | | | | | | | | | | | | | Wheat, ... | 3 | 2·63 | | | | | | | | | Wheat, ... | 2 | 2·63 | 12·0 | 0·109 | ·109 | | |
| | | | | | | | | | | | | | | Garden, ... | 10 | 1·40 | | | | | | | | | Garden, ... | 3 | 1·40 | 8·5 | 0·102 | ·102 | | |
| 178 | „ ... | 1 | 2 | 2·86 | 11·0 | 17·5 | 13·6 | „ ... | „ ... | 3 | 1·70 | 5·10 | 20 | Barley, ... | 3 | 2·00 | 16·8 | 67 | „ ... | 3 | 1·70 | 15 | ·113 | ·113 | Barley, ... | 1·37 | 2·00 | 7 | ·130 | ·130 | | |
| | „ ... | 1 | 1 | | 11·6 | 14·6 | | | | | | | | Wheat, ... | 4 | 2·70 | | | | | | | | | Wheat, ... | 2 | 2·70 | 14 | ·178 | ·178 | | |
| 180 | „ ... | 1 | 2 | 2·475 | 11 | 14 | 12·5 | „ ... | „ .. | ... | ... | ... | ... | Barley, ... | 3 | 0·66 | 28 | 121 | „ ... | ... | ... | ... | ... | ... | Barley, ... | 1·6 | 0·66 | 7·5 | ·070 | ·070 | | |
| | | | | | | | | | | | | | | Wheat, ... | 4 | 6·00 | | | | | | | | | Wheat, ... | 1·5 | 6·00 | 64 | ·070 | ·070 | | |
| | | | | | | | | | | | | | | Opium, ... | 10 | 0·20 | | | | | | | | | Opium, ... | 2 | 0·20 | 2 | ·100 | ·100 | | |
| | | | | | | | | | | | | | | Barley, ... | 2 | 1·80 | 30 | 192 | | | | | | | Barley, ... | 1·82 | 1·80 | 27 | ·060 | ·060 | | |
| | | | | | | | | | | | | | | Gujai, ... | 3 | 1·26 | | | | | | | | | Gujai, ... | 2 | 1·26 | 18 | ·070 | ·070 | | |
| 188 | „ ... | 1 | 2 | 2·62 | 10·6 | 13·4 | 12 | Dumat, ... | „ ... | ... | ... | ... | ... | Wheat, ... | 4 | 2·30 | | | „ ... | ... | ... | ... | ... | ... | Wheat, ... | 2 | 2·30 | 37 | ·062 | ·062 | | |
| | | | | | | | | | | | | | | Opium, ... | 8 | 1·00 | | | | | | | | | Opium, ... | 2 | 1·00 | 13 | ·080 | ·080 | | |
| | | | | | | | | | | | | | | Carrots, .. | 10 | 0·54 | | | | | | | | | Carrots, ... | 3 | 0·54 | 125 | ·070 | ·070 | | |

( A )

TABLE A.—*Observation and Experiment*—(Continued).

| Serial Number. | EXPERIMENTAL. WORK. Duration of work, minutes. | No. of lifts. | Cubic feet lifted. Per pair of cattle per hour. | Per lift, per hour. | Total per well. | H. P. Per bullock. | Total per well. | Length of watercourse. | Area Irrigated. Crop. | Watering. | Interval. | Area in square feet. | Depth. On area. | Of damp. | Days to an Acre. Per pair of cattle. | Per lift. | Per well. | Duty per pair. | COST. Annual. Interest at 5 p. c. | Repairs, &c. | Total. | Per Acre. Per acre Irrigated. | Lifting. | Total. | Remarks. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 92 | 93 | 94 | 95 | 96 | 97 | 98 | 99 | 100 | 101 | 102 | 103 | 104 | 105 | 106 | 107 | 108 | 109 | 110 | 111 | 112 | 113 | 114 | 115 | 116 |
| 150 | 480 | 347 | 77 | 230 | 1,835 | ·550 | 264 | 970 | Wheat, ... | 2 | 60 days | 10,055 | ·182 | ·5 | 12·9 | 4·3 | 4·3 | ... | 10·1 | 9·0 | 19·1 | | | | |
| 153 | 473 | 941 | 124 | 279 | 4,394 | ·988 | 467 | 410 | Wheat, ... | 2 | 30 days | 19,230 | ·228 | ·70 | 10·0 | 4·5 | 2·26 | ... | 15·3 | 15·0 | 30·3 | | | | |
| 155 | 557 | 1,745 | 158 | 158 | 5,890 | ·700 | 388 | 1,760 | Guchana, ... | 2 | 45 days | 24,356 | ·241 | ·55 | 7 | 7 | 1·8 | ... | 10·5 | 25·0 | 35·5 | | | | |
| 160 | 545 | 2,007 | 84·6 | 86 | 5,586 | ·381 | 208 | 740<br>1,650 | Barley, .. | 2<br>2 | 45 days<br>38 days | 20,763<br>10,430 | ·180 | ·55 | 8·6 | 8·4 | 1·4 | ... | 10·7 | 31·0 | 41·7 | | | | |
| 166 | 380 | 499 | 129 | 129 | 1,628 | ·489 | 186 | 660 | Carrots, ... | 2 | ... | 11,166 | ·145 | ·60 | 7·8 | 7·8 | 1·5 | ... | 6·8 | 30 | 36·8 | | | | |
| 167 | 585 | 2,047 | 100 | 115 | 6,697 | ·381 | 223 | 2,400 | Wheat, ... | 2 | 40 days | 18,040 | ·37 | 1·0 | 16·8 | 14·4 | | | | | | | | | |
| 170 | 380 | 430 | 110 | 110 | 1,403 | ·352 | 134 | 810 | Barley, .. | 2 | 45 days | 8,252 | ·167 | ·70 | 10·5 | 10·5 | 5·27 | ... | 10·3 | 13·0 | 23·3 | | | | |
| 173 | 118 | 1,413 | 92 | 92 | 3,815 | ·533 | 329 | 2,100 | Barley, ... | 2 | 50 days | 9,892 | ·38 | ·80 | 17·6 | 17·6 | 4·4 | ... | 8·1 | 22 | 30·1 | | | | |
| 178 | 560 | 1,040 | 106 | 106 | 2,974 | ·438 | 245 | 1,960 | Wheat, ... | 2 | 60 days | 10,934 | ·27 | ·55 | 12 | 12 | 4 | ... | 13·1 | 17·0 | 30·1 | | | | |
| 180 | 570 | 823 | 107 | 107 | 2,037 | ·392 | 223 | 650 | Wheat, ... | 2 | 45 days | 10,025 | ·20 | ·60 | 8·7 | 8·7 | 4·34 | ... | 5·3 | 11·0 | 16·3 | | | | |
| 183 | 574 | 817 | 112 | 112 | 2,140 | ·380 | 223 | 370 | Wheat, ... | 2 | 60 days | 6,840 | ·31 | 1·0 | 12·7 | 12·7 | 6·4 | ... | 5·3 | 11·0 | 16·3 | | | | |

TABLE A.—*Observation and Experiment*—(Continued).

STATISTICAL.

| Serial Number. | Locality: Province. | Locality: District. | Locality: Pergunna. | Locality: Village. | Year. | Area in Acres: Actual area in acres. | Area in Acres: Percentage unculti-vated. Waste. | Area in Acres: Percentage unculti-vated. Culturable. | Cultivated Area: Percentage of actual area cultivated. | Cultivated Area: Double cropped area in acres. | Cultivated Area: Total area actually cultivated in the year. | Percentage of Total Cultivated Area: Wet. | Percentage of Total Cultivated Area: Dry. | Kharif. Wet. Wells. | Kharif. Wet. Canals. | Kharif. Wet. Other sources. | Kharif. Dry. | Kharif. Total. | Rabi. Wet. Wells. | Rabi. Wet. Canals. | Rabi. Wet. Other sources. | Rabi. Dry. | Rabi. Total. | Irrigation Wells. Lime masonry. | Irrigation Wells. Dry bricks. | Irrigation Wells. Kacha. | Irrigation Wells. Total. | Lifts. Leather bucket. | Lifts. Earthen pots. | Lifts. Total. | Usual labor for lifting buckets. | Average area per lift, in acres. Kharif. | Average area per lift, in acres. Rabi. | Average area per lift, in acres. Total. | Remarks. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 |
| 188 | | | Etah, .. | Bazipur, .. | 1879-80 | 1224·2 | 33·82 | 14·78 | 51·40 | .. | 629·4 | 93·2 | 6·8 | 26·2 | .. | .. | 1·70 | 27·9 | 67·0 | .. | .. | 5·1 | 72·1 | 4 *p*-31<br>1 *p*-5 | .. | 1 *p*-2 | 38 | 131 | .. | 131 | Bullock, | 1·26 | 3·22 | 4·48 | |
| | | ETAH. | „ .. | „ .. | 80-81 | 1224·2 | 33·80 | 12·20 | 54·00 | .. | 659·6 | 75·1 | 24·9 | 39·4 | .. | .. | 10·6 | 50·0 | 35·7 | .. | .. | 14·3 | 50·0 | 4 *p*-31<br>1 *p*-5 | .. | 1 *p*-3 | 39 | 132 | .. | 132 | „ | 2·00 | 1·78 | 3·78 | |
| 195 | | | Márehra, .. | Tekhpur Khas, | 79-80 | 1202 | 9·62 | 13·60 | 76·78 | 291·6 | 1214·4 | 40·49 | 59·51 | 0·72 | 25·46 | .. | 33·65 | 59·83 | 2·57 | 11·74 | .. | 25·86 | 40·70 | 2 *p*-2<br>1 *p*-7 | .. | 1 *p*-6 | 15 | 12 | .. | 12 | „ | 0·73 | 2·65 | 3·38 | |
| | | | „ .. | „ .. | 80-81 | 1202 | 9·60 | 13·55 | 76·85 | 343·6 | 1267·1 | 49·79 | 50·21 | 4·21 | 29·70 | 0·49 | 22·11 | 56·51 | 3·18 | 12·16 | 0·05 | 28·10 | 43·49 | 2 *p*-2<br>1 *p*-7 | .. | 1 *p*-9 | 18 | 20 | .. | 20 | „ | 2·67 | 2·01 | 4·68 | |
| 200 | | | Secunder Rao, | Secunder Rao, | 79-80<br>80-81 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | |
| 207 | N. W. P. | | „ .. | Gopi, .. | 79-80 | 4141·7 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | |
| | | | „ .. | „ .. | 80-81 | 4141·7 | 35·6 | 9·6 | 54·8 | 208·66 | 2476·86 | 69·86 | 30·14 | 22·08 | 6·98 | 1·90 | 26·60 | 57 56 | 22·97 | 15·67 | ·26 | 3·54 | 42·44 | 4 *p*-5<br>3 *p*-5<br>2 *p*-11<br>1 *p*-7 | .. | 2 *p*-6<br>1 *p*-30 | 64 | 106 | .. | 106 | „ | 5·16 | 5·35 | 10·51 | All wells worked Kili with 2 to 3 pairs of cattle to each lift. |
| 217 | | ALIGARH. | „ .. | Nánu, .. | 79-80 | 1995·7 | 34·88 | 5·14 | 59·98 | 207·91 | 1380·9 | 56·2 | 43·8 | 7·6 | 8·7 | .. | 20·7 | 37·0 | 16·1 | 23·8 | .. | 23·1 | 63·0 | 2 *p*-4<br>1 *p*-5 | 1 *p*-2 | .. | .. | .. | .. | .. | .. | .. | .. | .. | As above. |
| | | | „ .. | „ .. | 80-81 | 1995·7 | 34·56 | 4·59 | 60·85 | 220·31 | 1410·4 | 75·0 | 25·0 | 9·0 | 25·7 | .. | 9·1 | 43·8 | 23·4 | 16·9 | .. | 15·9 | 56·2 | 2 *p*-4<br>1 *p*-5 | 1 *p*-2 | 1 *p*-15<br>1 *p*-14 | 26<br>25 | 30<br>29 | ..<br>.. | 30<br>29 | „<br>„ | 3·5<br>4·38 | 7·42<br>11·37 | 10·92<br>15·75 | |
| | | | Aligarh, .. | Dodepur, .. | 79-80 | 314·23 | 29·7 | 2·4 | 67·9 | 34·66 | 248·16 | 66·5 | 33·5 | 17·2 | .. | .. | 22·2 | 39·4 | 49·3 | .. | .. | 11·3 | 60·6 | 4 *p*-4<br>2 *p*-2 | | | | | | | | | | | |
| | | | „ .. | „ .. | 80-81 | 314·23 | 30·1 | 1·2 | 68·7 | 40·5 | 256·1 | 65·5 | 34·5 | 14·0 | .. | .. | 30·0 | 44·0 | 51·5 | .. | .. | 4·5 | 56·0 | 1 *p*-2<br>4 *p*-4<br>2 *p*-1<br>1 *p*-3 | .. | 1 *p*-3<br>1 *p*-3 | 11<br>11 | 25<br>24 | ..<br>.. | 25<br>24 | „<br>„ | 1·71<br>1·48 | 4·9<br>5·5 | 6·61<br>6·98 | Very good cattle in this village.<br>„ „ |

TABLE A.—*Observation and Experiment*—(Continued).

| DESCRIPTIVE. | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Serial Number. | *Date.* Day. | Month. | Year. | Number of Well. | *Class.* | *Cost.* Construction. | Fittings. | Total. | Renewal. | Lifts. | Yearly repairs. | Total. | *Supply.* | *Quality.* | *Substratum.* | *Cultivators on well.* Number. | Caste. | *Labor and cost per day in annas.* Men, home. | Do. hired. | Rate, per day. | Cattle. | Cost for men. | Do. for cattle. | Total cost, per day. |
| 37 | 38 | 39 | 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 | 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 | 61 |
| 188 | 28 | 1 | 82 | 286 | Masonry, .. | 250/- | 9/- | 259/- | .. | 6/- | 1/- | 19/- | Spring, .. | Sweet, .. | Clay 30′, | 1 Writer, 5 Lodhas, 1 Thakur, 1 Fruit seller, | | 6 | 1 | 1·5 | 4 | 6·5 | 12 | 1/2/6 |
| 192 | 28 | 1 | 82 | 365 | „ .. | 100/- | 6/- | 106/- | .. | 5/- | 2/- | 12/- | „ .. | „ .. | „ 30′, | 1 Thakur, 10 Lodhas, | | 3 | .. | .. | 4 | 2 | 6 | -/8/- |
| 195 | 29 | 1 | 82 | 485 | Kacha lined, .. | 14/- | 3/- | 17/- | 2/- | 5/- | 1/- | 8/- | „ .. | „ .. | „ 36′, .. | 1 | Thakur, .. | 3 | .. | .. | 4 | 2 | 6 | -/8/- |
| 196 | 29 | 1 | 82 | 508 | Masonry, .. | 200/- | 3/- | 203/- | .. | 8/- | 1/- | 9/- | „ .. | „ .. | „ 36′, | 1 Pandit, 7 Thakurs, 1 Clerk, | | .. | 3 | 1·5 | 2 | 4·5 | 3 | -/7/6. |
| 200 | 30 | 1 | 82 | 485 | „ .. | 150/- | 3/- | 153/- | .. | 8/- | 1/- | 9/- | „ .. | „ .. | „ 24′, | 1 Pathan, 1 Dhobi, | | .. .. | 2 | 1·25 | 4 | 3 | 6 | -/9/- |
| 203 | 30 | 1 | 82 | 476 | „ .. | 100/- | 3/- | 103/- | .. | 8/- | 4/- | 12/- | Percolation, | „ .. | „ 24′, .. | 1 | Ahir, .. | 2 | 1 | 1·25 | 4 | 2·21 | 6 | -/8/3 |
| 207 | 31 | 1 | 82 | 1,123 | „ .. | 200/- | 3/- | 203/- | .. | 8/- | 2/- | 10/- | Spring, .. | „ .. | „ 30′, | 1 Thakur, 5 Chamars, | | 1 | 2 | 1·5 | 6 | 3 | 9 | -/12/- |
| 211 | 31 | 1 | 82 | 1,139 | Dry brick, .. | 150/- | 6/- | 156/- | .. | 8/- | 1/- | 17/- | „ .. | „ .. | „ 33′, | 2 Chamars, 1 Thakur, | | 6 | .. | .. | 6 | 5 | 9 | -/14/- |
| 217 | 1 | 2 | 82 | 94 | Masonry, .. | 150/- | 6/- | 156/- | .. | 10/- | 1/- | 21/- | „ .. | „ .. | „ 42′, .. | 7 | Musalmen, .. | 3 | 4 | 2·0 | 12 | 10 | 18 | 1/12/- |
| 221 | 1 | 2 | 82 | 162 | „ .. | 100/- | 3/- | 103/- | .. | 10/- | 3/- | 13/- | „ .. | „ .. | „ 40′, | 1 Musalman, 4 Kachis, Thakur, | | 2 | 1 | 1·5 | 2 | 2·5 | 3 | -/5/6 |
| 225 | 2 | 2 | 82 | 174 | „ .. | 250/- | 10/- | 260/- | .. | 10/- | 1/- | 31/- | „ .. | „ .. | „ .. | 7 | Chamars, .. | 7 | .. | .. | 12 | 6 | 18 | 1/8/- |

TABLE A.—*Observation and Experiment*—(Continued).

| Serial Number. | EXPERIMENTAL. | | | | | | | | COMMAND. | | | | | | | | AREA IRRIGATED TO DATE. | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | *Run.* | | *Lift.* | | *Depth to Wells.* | | | Soil. | *Kharif* 1881-82. | | | | | *Rabi* 1881-82. | | | | | *Kharif* 1881-82. | | | | | | *Rabi* 1881-82. | | | | | |
| | Class. | Pairs of cattle to each lift. | Number. | Content in cubic feet. | Morning. | Evening. | Mean. | | Crop. | Waterings required. | Area. | Total area reduced to one watering. | No. of days to area. | Crop. | Waterings required. | Area. | Total area reduced to one watering. | No. of days to area. | Crop. | Waterings given. | Area. | Working days to date. | *Duty.* Per lift. | *Duty.* Per pair. | Crop. | Waterings given. | Area. | Working days to date. | *Duty.* Per lift. | *Duty.* Per pair. |
| | 62 | 63 | 64 | 65 | 66 | 67 | 68 | 69 | 70 | 71 | 72 | 73 | 74 | 75 | 76 | 77 | 78 | 79 | 80 | 81 | 82 | 83 | 84 | 85 | 86 | 87 | 88 | 89 | 90 | 91 |
| 188 | Lagor, .. / Kili, .. | 1 / 2 | 2 / 1 | 2·77 / 5·03 | 16·6 | 22·8 | 19·7 | Dumat, .. | Sugarcane, | .. | .. | .. | .. | Barley, .. / Wheat, .. | 3 / 4 | 1·32 / 7·63 | 34·5 | 45 | Sugarcane, | .. | .. | .. | .. | .. | Barley, .. / Wheat, .. | 2 / 2·6 | 1·32 / 7·63 | 4 / 71 | ·220 / ·093 | ·165 / ·071 |
| 192 | Lagor, .. | 1 | 2 | 2·88 | 16·6 | 22·6 | 19·5 | „ .. | „ .. | .. | .. | .. | .. | Barley, .. / Wheat, .. / Carrots, .. | 3 / 4 / 8 | 4·0 / 1·3 / 1·10 | 2·6 | 201 | „ .. | .. | .. | .. | .. | .. | Barley, .. / Wheat, .. / Carrots, .. | 2 / 3 / 4 | 4·0 / 1·3 / 1·10 | 54 / 24 / 25 | ·074 / ·081 / ·090 | ·074 / ·081 / ·090 |
| 195 | Kili, .. | 2 | 1 | .. | .. | .. | 18 | „ .. | „ .. | .. | .. | .. | .. | Wheat, .. | 4 | 1·6 | 6·4 | 32 | „ .. | .. | .. | .. | .. | .. | Wheat, .. | 3 | 1·6 | 24 | ·200 | ·100 |
| 196 | „ 2 Lift, .. | 1 | 1 | 5·5125 | 18 | 21·5 | 19·75 | „ .. | „ .. | .. | .. | .. | .. | Wheat, .. / Oats, .. / Barley, .. | 4 / 6 / 3 | 1·7 / 0·243 / 4·13 | 20·7 | 64 | „ .. | .. | .. | .. | .. | .. | Wheat, .. / Oats, .. / Barley, .. | 3 / 4 / 2·7 | 1·7 / ·243 / 4·13 | 25·5 / 4 / 53·5 | ·200 / ·243 / ·208 | ·200 / ·243 / ·208 |
| 200 | „ „ .. | 2 | 1 | 5·625 | 11 | 12 | 11·5 | „ .. | „ .. | .. | .. | .. | .. | Barley, .. / Wheat, .. | 3 / 4 | 0·73 / 8·70 | 37 | 74 | „ .. | .. | .. | .. | .. | .. | Barley, .. / Wheat, .. | 3 / 2 | 0·73 / 8·70 | 5·5 / 46·5 | ·200 / ·187 | ·100 / ·093 |
| 203 | „ .. | 2 | 1 | 5·0625 | 11 | 18 | 14·5 | „ .. | „ .. | .. | .. | .. | .. | Gram, .. / Gujai, .. / Wheat, .. | 1 / 2 / 3 | 2·11 / 1·43 / 4·98 | 20 | 100 | „ .. | .. | .. | .. | .. | .. | Gram, .. / Gujai, .. / Wheat, .. | 1 / 1 / 2 | 2·11 / 1·43 / 4·98 | 10 / 5 / 57 | 0·211 / 0·286 / 0·174 | ·105 / ·143 / ·087 |
| 207 | „ .. | 3 | 1 | 5·5125 | 16·6 | 21 | 18 8 | Matyar, .. | Cotton, .. | 2 | 3·57 | 7·14 | 20 | Barley, .. / Wheat, .. / Tobacco, .. / Opium, .. | 3 / 4 / 10 / 10 | 5·54 / 3·50 / 0·57 / 0·30 | 39·32 | 111 | Cotton, .. | 1 | 3·57 | 11 | ·324 | ·162 | Barley, .. / Wheat, .. / Tobacco, .. / Opium, .. | 2 / 2·7 / 1 / 4 | 5·54 / 3·5 / 0·57 / 0·30 | 31 / 24·5 / 1 / 2·8 | ·357 / ·386 / ·570 / ·460 | ·179 / ·193 / ·285 / ·230 |
| 211 | „ .. | 1·5 | 2 | 5·7937 | 15·5 | 16·5 | 16·0 | „ .. | „ .. | 2 | 2·43 | 4·86 | 7 | Barley, .. / Gujai, .. / Wheat, .. / Opium, .. / Tobacco, .. | 3 / 3 / 4 / 10 / 10 | 3·83 / 1·71 / 2·03 / 0·2 / 1·28 | 39·5 | 56 | „ .. | 1 | 2·43 | 4·2 | ·290 | ·193 | Barley, .. / Gujai, .. / Wheat, .. / Opium, .. / Tobacco, .. | 2 / 2·3 / 2·6 / 5 / 1 | 3·83 / 1·71 / 2·03 / 0·2 / 1·28 | 13·5 / 6·2 / 8·0 / 2·5 / 2·5 | ·283 / ·293 / ·330 / ·200 / ·256 | ·188 / ·195 / ·220 / ·133 / ·171 |
| 217 | „ .. / „ .. | 3 / 3 | 1 / 1 | 7·0875 / 6·75 | 12 | 19·6 | 15·8 | Dumat, / „ | „ .. | .. | .. | .. | .. | Barley, .. / Wheat, .. / Gram, .. | 2 / 3 / 1 | 8·75 / 10·9 / 2·8 | 53 | 69 | „ .. | .. | .. | .. | .. | .. | Barley, .. / Wheat, .. / Gram, .. | 2 / 2 / 1 | 8·75 / 10·90 / 2·80 | 50 / 64 / 10 | ·350 / ·356 / ·280 | ·117 / ·118 / ·093 |
| 221 | Kili, 2 pairs of cattle generally used, .. | 1 | 1 | 6·6375 | 9 | 20 | 17·5 | „ .. | „ .. | .. | .. | .. | .. | Barley, .. / Wheat, .. / Oats, .. | 2 / 3 / 6 | 4·91 / 11·34 / ·114 | 44·5 | 104 | „ .. | .. | .. | .. | .. | .. | Barley, .. / Wheat, .. / Oats, .. | 1·6 / 2 / 2 | 4·91 / 11·34 / ·114 | 23 / 76 / 2 | ·341 / ·300 / ·114 | ·170 / ·150 / ·114 |
| 225 | Kili, .. | x | 3 | .. | 20 | .. | .. | „ .. | „ .. | .. | .. | .. | .. | Peas, .. / Barley, .. / Wheat, .. | 2 / 3 / 5 | 1·86 / 7·43 / 13·57 | 93 | 186 | „ .. | .. | .. | .. | .. | .. | Peas, .. / Barley, .. / Wheat, .. | 1·6 / 2 / 2·75 | 1·86 / 7·43 / 13·57 | 5 / 30·5 / 76 | ·198 / ·167 / ·164 | x / x / x |

TABLE A.—*Observation and Experiment*—(Continued).

| Serial Number. | EXPERIMENTAL. WORK. Duration of work, minutes. | No. of lifts. | Cubic feet lifted. Per pair of cattle per hour. | Per lift, per hour. | Total per well. | H. P. Per bullock. | Total per well. | Length of watercourse. | Area Irrigated. Crop. | Watering. | Interval. | Area in square feet. | Depth. On area. | Of damp. | Days to an Acre. Per pair of cattle. | Per lift. | Per well. | Duty per pair. | COST. Annual. Interest at 5 p. c. | Repairs, &c. | Total. | Per Acre. Per acre irrigated. | Lifting. | Total. | Remarks. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 92 | 93 | 94 | 95 | 96 | 97 | 98 | 99 | 100 | 101 | 102 | 103 | 104 | 105 | 106 | 107 | 108 | 109 | 110 | 111 | 112 | 113 | 114 | 115 | 116 |
| 188 | 592 | 785<br>588 | 111<br>151 | 111<br>302 | 2,174<br>2,957 | ·655<br>·875 | 388<br>518 | 660 | Wheat, .. | 3 | 30 days | 33,300 | ·154 | ·7 | 5·3 | 4·0 | 1·3 | .. | 12·9 | 19· | 31·9 | | | | |
| 192 | 577 | 1,002 | 150 | 150 | 2,886 | ·880 | 508 | 220 | Wheat, .. | 3 | 30 days, | 5,630 | ·5 | ·66 | 15·5 | 15·5 | 7·75 | .. | 5·3 | 12·0 | 17·3 | | | | |
| 195 | .. | .. | .. | .. | .. | .. | .. | .. | „ .. | 3 | .. | 8,712 | .. | .. | 10·0 | 10·0 | 5·0 | .. | 0·8 | 8·0 | 8·8 | | | | |
| 196 | 474 | 385 | 269 | 269 | 2,122 | 1·469 | 696 | 780<br>780 | Oats, ..<br>Barley, .. | 5<br>3 | 30 days,<br>30 days, | 4,776<br>9,167 | ·152<br>·152 | ·5<br>·5 | 3·1 | 3·1 | 3·1 | .. | 10·1 | 9·0 | 19·1 | | | | |
| 200 | 430 | 292 | 114 | 229 | 1,642 | ·350 | 150 | 420 | „ .. | 3 | 30 days, | 10,600 | ·155 | ·75 | 8·2 | 4·1 | 2·0 | .. | 7·6 | 9·0 | 16·6 | | | | |
| 203 | 382 | 334 | 133 | 266 | 1,691 | ·612 | 234 | 1,260 | Wheat, .. | 3 | 30 days, | 8,708 | ·194 | ·62 | 10·0 | 5·0 | 5 | .. | 5·1 | 12·0 | 17·1 | | | | |
| 207 | 352 | 660 | 205 | 616 | 3,638 | 1·103 | 388 | 610 | „ .. | 3 | 37 days, | 15,440 | ·235 | ·75 | 8·46 | 2·82 | 2·82 | .. | 10·1 | 10·1 | 20·1 | | | | |
| 211 | 337 | 667 | 230 | 345 | 3,865 | ·955 | 322 | 980 | „ .. | 3 | 45 days, | 30,540 | ·126 | ·16 | 4·26 | 2·84 | 1·42 | .. | 7·8 | 17·0 | 24·8 | | | | |
| 217 | 546<br>.. | 569<br>648 | 148<br>160 | 443<br>480 | 4,033<br>4,374 | ·727<br>·800 | 397<br>432 | 300<br>1,600 | Barley, ..<br>Wheat, .. | 2<br>2 | 60 days,<br>30 days, | 17,082<br>16,557 | ·236<br>·260 | ·80<br>·75 | 7·5<br>7·8 | 2·5<br>2·6 | 1·3 | .. | 7·8 | 21.0 | 28·8 | | | | |
| 221 | 490 | 501 | 405 | 405 | 3,325 | 2·052 | 1,005 | 430 | „ .. | 2 | 30 days, | 18,663 | ·18 | ·80 | 2·33 | 2·33 | 2·33 | .. | 5·1 | 13·0 | 18·1 | | | | |
| 225 | .. | .. | .. | .. | .. | .. | .. | x | x .. | x | .. | 22,000 | .. | .. | .. | 6 | 2 | .. | 13·0 | 31·0 | 44·0 | | | | |

TABLE A.—*Observation and Experiment*—(Continued).

STATISTICAL.

| Serial Number. | Locality. | | | | Year. | Area in Acres. | | | Cultivated Area. | | | Percentage of Total Cultivated Area. | | | | | | | | | | Irrigation Wells. | | | | Lifts. | | | Usual labor for lifting buckets. | Average area per lift in acres. | | | Remarks. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Province. | District. | Pergunna. | Village. | | Actual area in acres. | Percentage uncultivated. | | Percentage of actual area cultivated. | Double cropped area in acres. | Total area actually cultivated in the year. | Wet. | Dry. | Kharif. | | | | Rabi. | | | | | Lime masonry. | Dry bricks. | Kucha. | Total. | Leather bucket. | Earthen pots. | Total. | | Kharif. | Rabi. | Total. | |
| | | | | | | | Waste. | Culturable. | | | | | | Wet. | | | Dry. | Total. | Wet. | | | Dry. | Total. | | | | | | | | | | | |
| | | | | | | | | | | | | | | Wells. | Canals. | Other sources. | | | Wells. | Canals. | Other sources. | | | | | | | | | | | | |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 |
| | N. W. P. | ALIGARH. | Hathras, .. | Bijari, .. | 1879-80 | 873·2 | 26·44 | 5·97 | 67·59 | 85·4 | 675·54 | 35·5 | 64·5 | 14·5 | .. | .. | 48·2 | 62·7 | 21·0 | .. | .. | 16·3 | 37·3 | 1 | .. | 49 | 50 | 37 | .. | 37 | Bullock, | 2·64 | 3·82 | 6·46 | |
| | | | | | 80-81 | 873·2 | 26·40 | 5·1 | 68·5 | 123·97 | 722·03 | 37·7 | 62·3 | 17·3 | .. | .. | 42·5 | 59·8 | 20·4 | .. | .. | 19·8 | 40·2 | 1 | .. | 73 | 74 | 37 | .. | 37 | „ | 3·38 | 4·00 | 7·38 | |
| | | | „ .. | Ramnpur, .. | 79-80 | 441·4 | 19·85 | 10·9 | 69·25 | 80·77 | 386 | 55·0 | 45·0 | 13·2 | .. | .. | 37·8 | 51·0 | 41·8 | .. | .. | 7·2 | 49·0 | 2 | .. | 42 | 44 | 25 | .. | 25 | „ | 2·07 | 6·56 | 8·63 | |
| | | | | | 80-81 | 441·4 | 19·85 | 8·9 | 71·25 | 112·77 | 427·27 | 60·7 | 39·3 | 16·0 | .. | .. | 35·0 | 51·0 | 44·7 | .. | .. | 4·3 | 49·0 | 2 | .. | 42 | 44 | 25 | .. | 25 | „ | 2·67 | 7·6 | 10·27 | |
| 259 | | | Iglas, .. | Sitapur, .. | 79-80 | 469·17 | 4·2 | 4·0 | 91·8 | 21·3 | 451·8 | 24·6 | 75·4 | .. | .. | .. | 51·3 | 51·3 | 24·6 | .. | .. | 24·1 | 48·7 | 8 *p*-2 | .. | 1 *p*-3 | 5 | 19 | .. | 19 | „ | .. | 5·80 | 5·80 | Splendid springs. |
| | | | | | 80-81 | 469.17 | 4·2 | 4·0 | 91·8 | 22.63 | 453·23 | 32·8 | 67·2 | 9·4 | .. | .. | 45·9 | 55·3 | 23·4 | .. | .. | 21·3 | 44.7 | 8 *p*-2 | .. | 1 *p*-4 | 6 | 20 | .. | 20 | „ | 2·12 | 5·3 | 7·42 | „ „ |
| 268 | | | „ .. | Iglas, .. | 79-80 | 469·94 | 13·5 | 5·5 | 81·0 | 58·1 | 438·7 | 44·1 | 55·9 | 9·1 | .. | .. | 40·4 | 49·5 | 35·0 | .. | .. | 15·5 | 50·5 | 4 *p*-3<br>2 *p*-3 | | | | | | | | | | | |
| 270 | | | „ .. | „ .. | 80-81 | 469·94 | 13·5 | 5·6 | 80·9 | 51·9 | 432·9 | 47·5 | 52·5 | 13·6 | .. | .. | 38·2 | 51·8 | 33·9 | .. | .. | 14·3 | 48·2 | 1 *p*-1<br>4 *p*-2<br>2 *p*-3 | .. | 1 *p*-16 | 23 | 35 | .. | 35 | „ | 1·11 | 4·38 | 5·49 | W. S. fallen 8' within last 5 years. |
| | | | | | 79-80 | 4137·66 | 17·9 | 13·1 | 69·0 | 885·26 | 3667·66 | 60·28 | 39·72 | 23·5 | .. | 1·3 | 30·0 | 54·8 | 35·4 | .. | 0·08 | 9·72 | 45·2 | 2 *p*-1<br>1 *p*-1<br>4 *p*-4<br>3 *p*-1<br>2 *p*-9 | .. | 1 *p*-34 | 40 | 51 | .. | 51 | „ | 1·14 | 2·88 | 4·02 | „ „ |
| | | | | | 80-81 | 4137.66 | 17·6 | 15·8 | 66·6 | 647·5 | 3382·1 | 67·3 | 32·7 | 22·0 | .. | 5·0 | 23·3 | 50·3 | 40·0 | .. | 8·3 | 9·4 | 49·7 | 1*p*-58<br>„ | 1 *p*-46<br>1 *p*-29 | 1 *p*-185<br>1 *p*-188 | 303<br>299 | 226<br>226 | .. | 226<br>226 | „<br>„ | 3·7<br>3·6 | 5·5<br>6·4 | 9·2<br>10·0 | „ „<br>„ „ |

TABLE A.—*Observation and Experiment*—(Continued).

| Descriptive | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Serial Number. | Date. Day. | Date. Month. | Date. Year. | Number of Well. | Class. | Cost. Construction. | Cost. Fittings. | Cost. Total. | Cost. Renewal. | Cost. Lifts. | Cost. Yearly repairs. | Cost. Total. | Supply. | Quality. | Substratum. | Cultivators on well. Number. | Cultivators on well. Caste. | Labor and cost per day in annas. Men, home. | Do. hired. | Rate, per day. | Cattle. | Cost for men. | Do. for cattle. | Total cost, per day. |
| 37 | 38 | 39 | 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 | 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 | 61 |
| 229 | 3 | 2 | 82 | 141 | Masonry, .. | 200/- | 3/- | 203/- | .. | 10/- | 4/- | 14/- | Percolation, | Sweet, .. | Sand, | .. | Chamars, .. | 2 | .. | .. | 2 | .. | .. | -/14/- |
| | | | | | | | | | | | | | | | | 4 | Chamars, .. | .. | .. | .. | .. | .. | .. | |
| 231 | .. | .. | .. | 139 | Kucha lined, .. | 12/- | 5/- | 17/- | 3/- | 10/- | 1/- | 14/- | Spring, .. | „ .. | Clay 37', .. | 2 | Lodhas, .. | 2 | 1 | 2 | 4 | 5 | 9 | |
| 234 | 3 | 2 | 82 | 114 | Masonry, .. | 300/- | 10/- | 310/- | .. | 9/- | 1/- | 28/- | „ .. | „ .. | „ 40', | 5 | Lodhas, | 6 | .. | .. | 4 | 5 | 6 | -/11/- |
| | | | | | | | | | | | | | | | | 1 | Herdsman, | | | | | | | |
| 238 | 4 | 2 | 82 | 237 | Kucha lined, .. | 9/- | 3/- | 12/- | 3/- | 8/- | 1/- | 12/- | „ .. | „ .. | „ 30', .. | 1 | Bania, .. | .. | 2 | 1·5 | 2 | 3·5 | 3 | -/6/6 |
| | | | | | | | | | | | | | | | | | | | 1 | ·5 | | | | |
| 242 | 4 | 2 | 82 | 235 | „ „ .. | 5/- | 2/- | 7/- | 2/- | 9/- | 1/- | 12/- | „ .. | „ .. | „ 30', | 2 | Musalman, .. | 1 | 2 | 1·5 | 4 | 3 | 6 | -/9/- |
| 248 | 4 | 2 | 82 | 8 | „ „ .. | 4/- | 2/- | 6/- | 1/- | 9/- | 1/- | 11/- | „ .. | „ .. | „ 40', | 1 | Jat, .. | 1 | 1 | 1·5 | 2 | 2·5 | 3 | -/5/6 |
| 251 | 5 | 2 | 82 | 145 | „ „ .. | 9/- | 2 - | 11/- | 0·5 | 9/- | 0·5 | 10/- | „ .. | Slightly Khatta | „ 32', | 1 | Jat, | 1 | 1 | 1·5 | 2 | 4 | 6 | -/10/- |
| | | | | | | | | | | | | | | | | 2 | Brahmins, | | 2 | 2 | | | | |
| 255 | 5 | 2 | 82 | 160 | Masonry, .. | 200/- | 4/- | 204/- | .. | 8/- | 1/- | 17/- | Percolation, | Sweet, .. | Sand, .. | 1 | Brahmin, | 2 | 1 | 2 | 2 | 3 | 3 | -/6/- |
| | | | | | | | | | | | | | | | | 1 | Jat, | | | | | | | |
| | | | | | | | | | | | | | | | | 1 | Chamar, .. | | | | | | | |
| 259 | 9 | 2 | 82 | 64 | „ .. | 800/- | 20/- | 820/- | .. | 9/- | 1/- | 64/- | Spring, .. | „ .. | Clay 78', | 1 | Poet, | 14 | 3 | 1·5 | 28 | 17·5 | 42 | 3/11/6 |
| | | | | | | | | | | | | | | | | 2 | Brahmins, | | | | | | | |
| | | | | | | | | | | | | | | | | 3 | Herdsmen, | | | | | | | |
| 265 | 9 | 2 | 82 | .. | „ .. | 800/- | 20/- | 820/- | .. | 9/- | 1/- | 73/- | „ .. | „ .. | „ .. | x | Brahmin, .. | 13 | 5 | 1·5 | 32 | 19·5 | 48 | 4/3/6 |
| 268 | 9 | 2 | 82 | 260 | „ .. | 400/- | 10/- | 410/- | .. | 9/- | 1/- | 37/- | „ .. | „ .. | „ .. | 2 | Kachis, .. | 4 | .. | .. | 4 | 3 | 6 | -/9/- |
| | | | | | | | | | | | | | | | | 1 | Brahmin, | | | | | | | |
| | | | | | | | | | | | | | | | | 2 | Herdsmen, | 4 | .. | .. | 4 | 3 | 6 | -/9/- |
| | | | | | | | | | | | | | | | | 1 | Fakir, | | | | | | | |
| 275 | 11 | 2 | 82 | 243 | „ .. | 300/- | 6/- | 306/- | .. | 8/- | 1/- | 17/- | „ .. | „ .. | „ 45', | 5 | Musalmen, | 2 | 3 | 1·5 | 4 | 5·5 | 6 | -/11/6 |
| | | | | | | | | | | | | | | | | 1 | Lodha, | | | | | | | |

( VIII )

TABLE A.—*Observation and Experiment*—(Continued).

| Serial Number. | EXPERIMENTAL. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | *Run.* | | *Lift.* | | *Depth to Wells.* | | | | COMMAND. | | | | | | | | | AREA IRRIGATED TO DATE. | | | | | | | | | | | | |
| | | | | | | | | | *Kharif* 1881-82. | | | | | *Rabi* 1881-82. | | | | | *Kharif* 1881-82. | | | | *Duty.* | | *Rabi* 1881-82. | | | *Duty.* | |
| | Class. | Pairs of cattle to each lift. | Number. | Content in cubic feet. | Morning. | Evening. | Mean. | Soil. | Crop. | Waterings required. | Area. | Total area reduced to one watering. | No. of days to area. | Crop. | Waterings required. | Area. | Total area reduced to one watering. | No. of days to area. | Crop. | Waterings given. | Area. | Working days to date. | Per lift. | Per pair. | Crop. | Waterings given. | Area. | Working days to date. | Per lift. | Per pair. |
| | 62 | 63 | 64 | 65 | 66 | 67 | 68 | 69 | 70 | 71 | 72 | 73 | 74 | 75 | 76 | 77 | 78 | 79 | 80 | 81 | 82 | 83 | 84 | 85 | 86 | 87 | 88 | 89 | 90 | 91 |
| 229 | Kili, .. | 1 | 1 | .. | 17 | .. | .. | Dumat, | Cotton, .. | 2 | 3·17 | 6·34 | .. | Kurr, .. | 3 | 0·6 | 65 | 110 | Cotton, .. | 1 | 3·17 | 11·5 | ·138 | ·092 | Kurr, .. | .. | 0·6 | .. | .. | .. |
| 231 | „ .. | 2 | 1 | 6·6375 | 17 | 24 | 20·5 | „ | | | | | | Peas, .. | 2 | 1·51 | | | | | | | | | Peas, .. | 1 | 1·51 | 6 | ·126 | ·084 |
| | | | | | | | | | | | | | | Barley, .. | 3 | 7·17 | | | | | | | | | Barley, .. | 2 | 7·17 | 42 | ·171 | ·113 |
| | | | | | | | | | | | | | | Wheat, .. | 5 | 7·86 | | | | | | | | | Wheat, .. | 2 | 7·86 | 44 | ·178 | ·119 |
| 234 | „ 34', .. | 1 | 1 | 6·75 | 18 | 20 | 19 | „ | | | | | | Gram, .. | 1 | 1·14 | 65·7 | 111 | | | | | | | Gram, .. | 1 | 1·14 | 1·7 | ·224 | ·224 |
| | | 1 | 1 | 4·6125 | .. | .. | .. | „ | „ .. | .. | x | .. | .. | Barley, .. | 3 | 5·03 | | | „ .. | .. | x | .. | .. | .. | Barley, .. | 2 | 5·03 | 15 | ·223 | ·223 |
| | | 1 | 1 | .. | .. | .. | .. | „ | | | | | | Wheat, .. | 5 | 7·34 | | | | | | | | | Wheat, .. | 3 | 7·34 | 30 | ·244 | ·244 |
| | | | | | | | | | | | | | | Tobacco, .. | 10 | 1·28 | | | | | | | | | Tobacco, .. | 2 | 1·28 | 23 | ·371 | ·371 |
| 238 | „ „ .. | 1 | 1 | 5·5 | 26 | 28 | 27 | „ .. | „ .. | .. | .. | .. | .. | Barley, .. | 4 | 1·12 | 8·63 | 53 | „ .. | .. | .. | .. | .. | .. | Barley, .. | 3 | 1·12 | 36 | ·162 | ·162 |
| | | | | | | | | | | | | | | Wheat, .. | 5 | 0·83 | | | | | | | | | Wheat, .. | 3 | 0·83 | | ·162 | ·162 |
| | | | | | | | | | | | | | | Tobacco, .. | 6 | 0·8 | | | | | | | | | Tobacco, .. | 2 | 0·8 | 4 | ·400 | ·200 |
| | | | | | | | | | | | | | | Potatoes, .. | 4 | 1·1 | | | | | | | | | Potatoes, .. | 4 | 1·1 | 16 | ·275 | ·137 |
| 242 | „ .. | 2 | 1 | 6·86 | 26 | 31 | 28·5 | „ .. | „ .. | .. | .. | .. | .. | Wheat, .. | 5 | 2·71 | 35 | 100 | „ .. | .. | .. | .. | .. | .. | Wheat, .. | 3·8 | 2·71 | 34 | ·302 | ·151 |
| | | | | | | | | | | | | | | Garlic, .. | 10 | 1·0 | | | | | | | | | Garlic, .. | 6 | 1·0 | 18 | ·333 | ·166 |
| | | | | | | | | | | | | | | Kurr & Carrots, | 3 | 0·83 | | | | | | | | | Kurr & Carrots, .. | 3 | 0·83 | 6 | ·415 | ·207 |
| 248 | „ .. | 1 | 1 | 6·6375 | .. | 38 | .. | „ .. | „ .. | .. | .. | .. | .. | Barley, .. | 4 | 4·9 | 39 | 263 | „ .. | .. | .. | .. | .. | .. | Barley, .. | 4·8 | 4·9 | 106 | ·222 | ·222 |
| | | | | | | | | | | | | | | Wheat, .. | 5 | 3·9 | | | | | | | | | Wheat, .. | 3·5 | 3·9 | 47 | ·290 | ·290 |
| 251 | „ .. | 2 | 1 | 7·14 | 38 | 40 | 39 | „ .. | „ .. | .. | .. | .. | .. | Barley, .. | 3 | 1·43 | | | | | | | | | Barley, .. | 3 | 1·43 | 12 | ·357 | ·178 |
| | | | | | | | | | | | | | | Wheat, .. | 4 | 3·63 | 21·45 | 120 | „ .. | .. | .. | .. | .. | .. | Wheat, .. | 3 | 3·63 | 36 | ·302 | ·151 |
| | | | | | | | | | | | | | | Carrots & Kurr, | 4 | 0·66 | | | | | | | | | Carrots, Kurr, | 4 | 0·66 | 8 | ·330 | ·165 |
| 255 | „ .. | 1 | 1 | 6·75 | 39 | 51 | 45 | „ | | | | | | Khurfa, .. | 4 | 1·0 | | | | | | | | | Khurfa, .. | 1 | 1·0 | 2·5 | ·200 | ·200 |
| | | | | | | | | | | | | | | Wheat, .. | 4 | 3·52 | 28·46 | 73 | | | | | | | Wheat, .. | 3 | 3·52 | 27·5 | ·192 | ·192 |
| | „ .. | 1 | 1 | 6·24 | .. | .. | .. | „ | „ .. | .. | .. | .. | .. | Barley, .. | 3 | 3·46 | | | „ .. | .. | .. | .. | .. | .. | Barley, .. | 2·2 | 3·46 | 16·0 | ·238 | ·238 |
| | | | | | | | | | | | | | | Barley, .. | 2 | 1·03 | | | | | | | | | Barley, .. | 2 | 1·03 | ·91 | ·323 | ·161 |
| | | | | | | | | | | | | | | Barley & Peas, | 2 | 9·94 | | | | | | | | | „ Peas, | 1·4 | 9·94 | 8·7 | ·228 | ·114 |
| 259 | „ 8*p* .. | 2 | 7 | 6·1425 | 23 | 36 | 29·5 | Sandy Dumat, | „ .. | .. | .. | .. | .. | Gujai, .. | 3 | 2·65 | 11·8 | 97 | „ .. | .. | .. | .. | .. | .. | Gujai, .. | 1 | 2·65 | 1·37 | ·276 | ·138 |
| | | | | | | | | | | | | | | Wheat, .. | 3 | 27·2 | | | | | | | | | Wheat, .. | 2 | 27·2 | 35·5 | ·219 | ·110 |
| | | | | | | | | | | | | | | Carrots & Kurr, | 5 | 1·32 | | | | | | | | | Carrots, Kurr. | 2 | 1·34 | 1·5 | ·255 | ·127 |
| 265 | „ 8*p* .. | 2 | 8 | 6·2 | 23 | 40 | 31·5 | Dumat, .. | „ .. | .. | .. | .. | .. | Rabi, .. | .. | .. | .. | .. | „ .. | .. | .. | .. | .. | .. | Rabi, .. | .. | .. | .. | .. | .. |
| | | | | | | | | | | | | | | Barley, .. | 2 | 4·5 | | | | | | | | | Barley, .. | 2 | 4·5 | 12 | ·187 | ·187 |
| 268 | „ .. | 1 | 2 | 5·74 | 17 | 29 | 23 | „ | | | | | | Gujai, .. | 3 | 3·4 | | | | | | | | | Gujai, .. | 2 | 3·4 | 6·8 | ·213 | ·213 |
| | | | | | | | | | | | | | | Wheat, .. | 3 | 9·9 | | | | | | | | | Wheat, .. | 2·66 | 9·9 | 41 | ·160 | ·160 |
| | „ .. | 1 | 2 | 6·27 | 17 | 29 | 23 | „ | „ .. | .. | .. | .. | .. | Carrots & Kurr, | 5 | 1·26 | 94 | 131 | „ .. | .. | .. | .. | .. | .. | Carrots, Kurr, | 5 | 1·26 | 9 | ·175 | ·175 |
| | | | | | | | | | | | | | | Tobacco, .. | 10 | 3·03 | | | | | | | | | Tobacco, .. | 6·4 | 3·03 | 25 | ·193 | ·193 |
| | | | | | | | | | | | | | | Garden, .. | 10 | 0·9 | | | | | | | | | Garden, .. | 5 | 0·90 | 5 | ·225 | ·225 |
| | | | | | | | | | | | | | | Gram & Kurr, .. | 1 | 0·23 | | | | | | | | | Gram & Kurr, | 1 | 0·23 | 1 | ·115 | ·115 |
| 275 | „ .. | 1 | 2 | 5·23 | 31·5 | 34 | 32·75 | „ .. | „ .. | .. | .. | .. | .. | Barley & Peas, | 3 | 11·30 | 49·7 | 75 | „ .. | .. | .. | .. | .. | .. | Barley, Peas, | 2·47 | 11·30 | 73 | ·191 | ·191 |
| | | | | | | | | | | | | | | Wheat, .. | 3 | 5·2 | | | | | | | | | Wheat, .. | 2·38 | 5·2 | 26 | ·238 | ·238 |

TABLE A.—*Observation and Experiment*—(Continued).

| Serial Number. | EXPERIMENTAL. WORK. Duration of work, minutes. | No. of lifts. | Cubic feet lifted. Per pair of cattle, per hour. | Per lift, per hour. | Total per well. | H. P. Per bullock. | Total per well. | Length of watercourse. | Area Irrigated. Crop. | Watering. | Interval. | Area in square feet. | Depth. On area. | Of damp. | Days to an Acre. Per pair of cattle. | Per lift. | Per well. | Duty per pair. | COST. Annual. Interest at 5 p. c. | Repairs, &c. | Total. | Per Acre. Per acre irrigated. | Lifting. | Total. | Remarks. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 92 | 93 | 94 | 95 | 96 | 97 | 98 | 99 | 100 | 101 | 102 | 103 | 104 | 105 | 106 | 107 | 108 | 109 | 110 | 111 | 112 | 113 | 114 | 115 | 116 |
| 229 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 1·7 | .. | 11·0 | 28·0 | 39·0 | | | | |
| 231 | 504 | 358 | 141 | 282 | 2,375 | ·861 | 434 | 460 | Wheat, .. | 3 | 30 days, | 15,945 | ·15 | ·70 | 5·4 | 2·7 | 2 *p* | .. | .. | .. | .. | | | | |
| 234 | 552 | 380 | 279 | 279 | 2,565 | 1·407 | 776 | | | | | | | | | | | | | | | | | | |
| | 490 | 318 | 180 | 180 | 1,464 | ·916 | 448 | 790 | Barley, .. | 3 | 30 days, | 15,360 | ·21 | ·10 | 4·5 | 4·5 | 1·7 | .. | 15·5 | 28·0 | 43·5 | | | | |
| | | | | | | | | 320 | Tobacco, .. | 2 | *x* | 3,836 | ·21 | 1·10 | | | 3 *p* | | | | | | | | |
| 238 | 428 | 231 | 179 | 179 | 1,270 | 1·273 | 545 | 300 | Barley, .. | 3 | 35 days, | 6,830 | ·18 | ·8 | 6·2 | 6·2 | 6·2 | .. | 0·6 | 12·0 | 12·6 | | | | |
| 242 | 467 | 289 | 127 | 254 | 1,982 | 1·000 | 467 | 150 | Wheat, .. | 3 | 60 days, | 6,924 | ·129 | ·60 | 5·7 | 2·85 | 2·85 | .. | 0·4 | 12·0 | 12·4 | | | | |
| | | | | | | | | 320 | Garlic, .. | 6 | 15 days, | 8,430 | ·129 | ·75 | | | | | | | | | | | |
| 248 | .. | .. | .. | .. | .. | .. | .. | 470 | Wheat, .. | 4 | .. | 6,448 | .. | .. | 6·75 | 6·75 | 6·75 | .. | 0·3 | 11·0 | 11·3 | | | | |
| 251 | 590 | 399 | 145 | 290 | 2,850 | 1·471 | 868 | 140 | Barley, .. | 3 | 60 days, | 2,640 | ·38 | ·60 | 11·2 | 5·6 | 5·6 | .. | 0·6 | 10·0 | 10·6 | | | | |
| | | | | | | | | 460 | Wheat, .. | 3 | 60 days, | 5,066 | ·38 | ·80 | | | | | | | | | | | |
| 255 | 453 | 220 | 196 | 196 | 1,485 | 2·574 | 1,166 | 300 | Khurfa, .. | 2 | 6 days, | 12,600 | ·113 | ·9 | 3·5 | 3·5 | 2·6 | .. | 10·2 | 17·0 | 17·2 | | | | |
| | 480 | 216 | 168 | 168 | 1,348 | 2·223 | 1,067 | 580 | Barley, .. | 2 | 30 days, | 4,374 | ·3 | ·85 | 10 | 10 | | | | | | | | | |
| 259 | 480 | 2,261 | 126 | 252 | 13,888 | 1·145 | 550 | 1,650 | Wheat, .. | 2 | 30 days, | 52,758 | ·259 | ·75 | 11·5 | 5·7 | 8·25 | .. | 41·0 | 64·0 | 10·5 | | | | |
| 265 | 480 | 2,400 | 116 | 232 | 14,880 | 1·200 | 574 | 1,500 | Wheat, .. | 2 | .. | 22,600 | ·27 | ·80 | 12·6 | 6·3 | ·8 | .. | 41 0 | 73 0 | 11·4 | | | | |
| | | | | | | | | 500 | Barley, .. | 2 | .. | 31,828 | ·27 | ·90 | | | | | | | | | | | |
| 268 | 540 | 732 | 233 | 233 | 4,200 | 1·722 | 930 | 1,500 | Wheat, .. | 3 | 60 days, | 13,420 | ·31 | ·75 | 6·4 | 6·4 | 1·4 | .. | 20·5 | 37· | 57·5 | | | | |
| | 540 | 774 | 270 | 270 | 4,853 | 2·000 | 1,079 | 1,000 | „ .. | 3 | 60 days, | 17,990 | ·31 | ·80 | 4·9 | 4·9 | | | | | | | | | |
| 275 | 510 | 714 | 220 | 220 | 3,734 | 1·925 | 982 | 650 | Barley, Peas, | 3 | 60 days, | 26,842 | ·139 | 1·0 | 3·24 | 3·24 | 1·62 | .. | 15·3 | 17·0 | 32·3 | | | | |

TABLE A.—*Observation and Experiment*—(Continued).

| Serial Number. | Province. | District. | Pergunna. | Village. | Year. | Statistical. Locality. Area in Acres. Actual area in acres. | Percentage uncultivated. Waste. | Culturable. | Cultivated Area. Percentage of actual area cultivated. | Double cropped area in acres. | Total area actually cultivated in the year. | Percentage of Total Cultivated Area. Wet. | Dry. | Kharif. Wet. Wells. | Canals. | Other sources. | Dry. | Total. | Rabi. Wet. Wells. | Canals. | Other sources. | Dry. | Total. | Irrigation Wells. Lime masonry. | Dry bricks. | Kacha. | Total. | Lifts. Leather bucket. | Earthen pots. | Total. | Usual labor for lifting buckets. | Average area per lift, in acres. Kharif. | Rabi. | Total. | Remarks. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 |
| 287 | N. W. P. | Muttra. | Sadabad, .. | Sadabad, .. | 1879-80 | 984·25 | 12·4 | 9·8 | 77·8 | 45·15 | 811·10 | 14·7 | 85·3 | 0·4 | .. | .. | 61·8 | 62·2 | 14·3 | .. | .. | 23·5 | 37·8 | 2 *p*-2 | | | | | | | | | | | |
| | | | „ .. | „ .. | 80-81 | 984·25 | 12·2 | 9·3 | 78·5 | 73·22 | 845·4 | 30·7 | 69·3 | 8·1 | .. | .. | 49·4 | 57·5 | 22·6 | .. | .. | 19·9 | 42·5 | 1 *p*-7<br>2 *p*-2 | 1 *p*-1 | 1 *p*-72 | 82 | 48 | .. | 48 | .. | 0·05 | 2·42 | 2·47 | |
| | | | | | | | | | | | | | | | | | | | | | | | | 1 *p*-7 | 1 *p*-1 | 1 *p*-79 | 89 | 50 | .. | 50 | .. | 1·38 | 3·83 | 5·21 | |
| 296 | | | „ .. | Munsia, .. | 79-80 | 997·81 | 4·3 | 2·6 | 93·1 | 41·72 | 971·20 | 43·6 | 56·4 | 2·3 | .. | .. | 47·4 | 48·7 | 41·3 | .. | .. | 9·0 | 50·3 | 3*p*-2<br>2*p*-3 | .. | .. | .. | .. | .. | .. | .. | .. | 0·34 | 6·08 | 6·42 | 2 pairs of cattle per lift generally used. |
| | | | „ .. | „ .. | 80-81 | 997·81 | 4·3 | 1·8 | 93·9 | 54·69 | 991·57 | 63·7 | 36·3 | 21·5 | .. | .. | 29·5 | 51·0 | 42·2 | .. | .. | 6·8 | 49·0 | 1*p*-1<br>„ | 1*p*-1 | 1*p*-153<br>1*p*-135 | 160<br>142 | 66<br>63 | ..<br>.. | 66<br>63 | ..<br>.. | ..<br>3·37 | ..<br>6·63 | ..<br>10·60 | „ „ W. S. fallen 6′. |
| 300 | | | Mahában, .. | Narhauli, .. | 79-80 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | |
| | | | „ .. | „ .. | 80-81 | 478·21 | 6·9 | 9·7 | 83·4 | 11·33 | 415·2 | 35·3 | 64·7 | 11·6 | .. | 2·0 | 57·7 | 61·3 | 21·7 | .. | .. | 7·0 | 29·7 | 2*p*-2<br>1*p*-2 | .. | 1*p*-50 | 54 | 31 | .. | 31 | .. | 1·54 | 2·91 | 4·45 | W. S. fallen lately. |
| 307 | | | „ .. | Chauli, .. | 79-80 | 981·30 | 19·9 | 2·7 | 77·4 | 7·9 | 767·5 | .. | .. | .. | .. | .. | 71·7 | .. | 18·0 | .. | .. | 10·3 | .. | 2*p*-1 | .. | 49 | 50 | 30 | .. | 30 | .. | .. | 4·61 | 4·61 | „ „ |
| 309 | | | „ .. | „ | 80-81 | 981·30 | 20·4 | 7·4 | 72·2 | 6·7 | 714·5 | .. | .. | 4·7 | .. | .. | 62·2 | .. | 20·9 | .. | .. | 12·2 | .. | 2*p*-1 | .. | 60 | 61 | 35 | .. | 35 | .. | 1·00 | 4·27 | 5·27 | „ „ |
| 312 | | | „ .. | Gonga, .. | 79-80 | 509·88 | 9·4 | 2·2 | 88·4 | 32·9 | 483·42 | 33·1 | 66·9 | .. | .. | .. | 57·3 | 57·3 | 33·1 | .. | .. | 9·6 | 42·7 | 2*p*-1<br>1*p*-12 | .. | 2*p*-3<br>1*p*-44 | 60 | 64 | .. | 64 | .. | .. | 2·5 | 2·5 | W. S. fallen 15′. |
| | | | | | 80-81 | 509·88 | 9·4 | 2·2 | 88·4 | 44·31 | 494·83 | 41·2 | 58·8 | 10·9 | .. | .. | 44·9 | 55·8 | 30·3 | .. | .. | 13·9 | 44·2 | „ | .. | „ | 60 | 64 | .. | 64 | .. | 0·84 | 2·34 | 3·18 | „ „ |
| | | | „ .. | Bhinia, .. | 79-80 | 293·85 | 4·1 | 1·7 | 94·2 | 15·20 | 292·02 | 22·1 | 77·9 | 0·6 | .. | .. | 63·2 | 63·8 | 21·5 | .. | .. | 14·7 | 36·2 | 2*p*-4 | .. | 1*p*-10 | 16 | 22 | .. | 22 | .. | 0·07 | 2·86 | 2·93 | „ „ |
| | | | | | 80-81 | 293·85 | 4·0 | 0·9 | 95·1 | 30·80 | 310·20 | 30·9 | 69·1 | 7·3 | .. | .. | 55·7 | 63·0 | 23·6 | .. | .. | 13·4 | 37·0 | 2*p*-3 | .. | 1*p*-32 | 25 | 28 | .. | 28 | .. | 0·81 | 2·61 | 3·42 | „ „ |

TABLE A.—*Observation and Experiment*—(Continued).

| DESCRIPTIVE. | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Serial Number. | *Date.* | | | Number of Well. | *Class.* | *Cost.* | | | | | | | *Supply.* | *Quality.* | *Substratum.* | *Cultivators on well.* | | *Labor and cost per day in annas.* | | | | | | | | | | |
| | Day. | Month. | Year. | | | Construction. | Fittings. | Total. | Renewal. | Lifts. | Yearly repairs. | Total. | | | | Number. | Caste. | Men, home. | Do. hired. | Rate, per day. | Cattle. | Cost for men. | Do for cattle. | Total cost, per day. | | | | | |
| 37 | 38 | 39 | 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 | 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 | 61 | | | | | |
| 279 | 11 | 2 | 82 | 240 | Masonry, 1st year, | 300/- | 3/- | 303/- | .. | 9/- | 1/- | 10/- | Spring, .. | Sweet, .. | Clay, 45', .. | 1 | Lodha, .. | 2 | 1 | 1·5 | 4 | 2·5 | 6 | -/8/6 | | | | | |
| 283 | 11 | 2 | 82 | 199 | Kucha unlined, 4 years' old, .. | 5/5 | -/5/- | 6/- | .. | 9/- | 1/- | 10/- | „ .. | „ .. | „ | 3 | Musalmen, .. | .. | 1 | 1·5 | 4 | 3 | 6 | -/9/- | | | | | |
| | | | | | | | | | | | | | | | | 1 | Carpenter, .. | .. | 1 | 1·0 | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | .. | 1 | 0·5 | | | | | | | | | |
| 287 | 6 | 2 | 82 | 224 | Kucha lined with wood, 3 years' old, .. | 21/5 | 4/- | 24/5 | .. | 10/- | 1/- | 11/- | „ .. | Slightly Kharra, .. | „ 50', .. | 1 | Brahmin, .. | .. | 2 | 1·75 | 2 | 4 | 3 | -/7/- | | | | | |
| | | | | | | | | | | | | | | | | | | .. | 1 | ·5 | | | | | | | | | |
| 291 | 6 | 2 | 82 | 118 | Kucha lined with wood, 15 years' old, | 21/5 | 4/- | 24/5 | .. | 8/- | 1/- | 9/- | „ .. | „ .. | „ 50', .. | 1 | Gujar, .. | 1 | 2 | 1·5 | 2 | 3 | 3 | -/6/- | | | | | |
| 294 | 6 | 2 | 82 | 63 | „ „ new, | 21/5 | 4/- | 24/5 | .. | 8/- | 1/- | 9/- | „ .. | „ .. | „ 48', .. | 1 | Brahmin, .. | 3 | .. | .. | 2 | 2 | 3 | -/5/- | | | | | |
| 296 | 6 | 2 | 82 | 1,738 | Masonry, 200 years' old, | 400/- | 6/- | 406/- | .. | 8/- | 1/- | 17/- | „ .. | Slightly Kharra, .. | „ | 4 | Jats, .. | 2 | 5 | 1·5 | 4 | 8·5 | 6 | -/14/6 | | | | | |
| | | | | | | | | | | | | | | | | 1 | Brahmin, .. | | | | | | | | | | | | |
| 300 | 7 | 2 | 82 | 370 | Masonry, old, .. | 400/- | 6/- | 406/- | .. | 8/- | 3/- | 19/- | Percolation, | Kharra, .. | Sand, .. | 2 | Brahmins, .. | .. | 5 | 2·0 | 4 | 1·0 | 6 | 1/- | | | | | |
| 304 | 7 | 2 | 82 | 385 | Kucha lined, 9 months' old, .. | 7·5 | 1·5 | 9/- | 1/- | 8/- | 1/- | 10/- | „ .. | Sweet, .. | „ .. | 1 | Brahmin, .. | 1 | 2 | 1·3 | 2 | 2·5 | 3 | -/5/8 | | | | | |
| 307 | 7 | 2 | 82 | 1,224 | Masonry, 60 years' old, .. | 1000/- | 6/- | 1006/- | .. | 9/- | 1/- | 19/- | Spring, .. | Kharra, .. | Clay, 78', .. | 1 | Jat, .. | 1 | 2 | 1·3 | 4 | 2·6 | 6 | -/8/- | | | | | |
| | | | | | | | | | | | | | | | | 1 | „ .. | .. | 2 | 1·3 | 4 | 3·6 | 6 | -/9/8 | | | | | |
| | | | | | | | | | | | | | | | | | | | 1 | 1·0 | | | | | | | | | |
| 312 | 8 | 2 | 82 | 8,467 | Masonry, .. | 300/- | 3/- | 303/- | .. | 8/- | 10/- | 18/- | Percolation was spring, | Sweet, .. | „ 68', .. | 1 | Byragi, .. | .. | 2 | 1·5 | 2 | 3·5 | 3 | -/6/6 | | | | | |
| 315 | 8 | 2 | 82 | 6,619 | Kucha lined, 3 years' old, .. | 6/- | 2/- | 8/- | 1/- | 9·5 | 1·5 | 11/- | Spring, .. | „ .. | „ 68', .. | 1 | Brahmin, .. | 2 | 1 | 1·0 | 4 | 2 | 6 | -/8/- | | | | | |
| 319 | 8 | 2 | 82 | 6,618 | Masonry, .. | 400/- | 4/- | 404/- | .. | 8/- | 3/- | 19/- | Percolation was spring, | „ .. | „ 68', | 1 | Jat, | 2 | 2 | 1·5 | 4 | 4 | 6 | -/10/- | | | | | |
| | | | | | | | | | | | | | | | | 2 | Brahmins, | | | | | | | | | | | | |

TABLE A.—*Observation and Experiment*—(Continued).

EXPERIMENTAL.

| Serial Number. | Run. Class. | Run. Pairs of cattle to each lift. | Lift. Number. | Lift. Content in cubic feet. | Depth to Wells. Morning. | Depth to Wells. Evening. | Depth to Wells. Mean. | Soil. | COMMAND. *Kharif* 1881-82. Crop. | Waterings required. | Area. | Total area reduced to one watering. | No. of days to area. | *Rabi* 1881-82. Crop. | Waterings required. | Area. | Total area reduced to one watering. | No. of days to area. | AREA IRRIGATED TO DATE. *Kharif* 1881-82. Crop. | Waterings given. | Area. | Working days to date. | Duty. Per lift. | Duty. Per pair. | *Rabi* 1881-82. Crop. | Waterings given. | Area. | Working days to date. | Duty. Per lift. | Duty. Per pair. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 62 | 63 | 64 | 65 | 66 | 67 | 68 | 69 | 70 | 71 | 72 | 73 | 74 | 75 | 76 | 77 | 78 | 79 | 80 | 81 | 82 | 83 | 84 | 85 | 86 | 87 | 88 | 89 | 90 | 91 |
| 279 | Kili, 6·5 *d*, .. | 2 | 1 | 5·7375 | 34·8 | 36 | 35·4 | Dumat, .. | .. | .. | .. | .. | .. | Barley, .. | 3 | 0·23 | 34·3 | 100 | .. | .. | .. | .. | .. | .. | Barley, .. | 3 | 0·23 | 25 | ·276 | ·138 |
| | | | | | | | | | | | | | | Wheat, .. | 4 | 2·23 | | | | | | | | | Wheat, .. | 3 | 2·23 | 24 | ·279 | ·139 |
| | | | | | | | | | | | | | | Carrots, .. | 5 | 4·94 | | | | | | | | | Carrots, .. | 3 | 4·94 | 36·5 | ·406 | ·203 |
| 283 | „ .. | 2 | 1 | .. | 27 | 28 | 27·5 | „ .. | .. | .. | .. | .. | .. | Barley, .. | 8 | 2·14 | 37·0 | 133 | .. | .. | .. | .. | .. | .. | Barley, .. | 4 | 2·14 | 24 | ·356 | ·178 |
| | | | | | | | | | | | | | | Barley & Peas, | 3 | 3·6 | | | | | | | | | „ Peas, | 2·4 | 3·6 | 27·5 | ·314 | ·157 |
| | | | | | | | | | | | | | | Wheat, .. | 4 | 2·3 | | | | | | | | | Wheat, .. | 3 | 2·3 | 21·5 | ·321 | ·160 |
| 287 | „ .. | 1 | 1 | 7·65 | 49·5 | 53 | 51·25 | Sandy, Dumat, .. | .. | .. | .. | .. | .. | Barley, .. | 4 | 1·37 | 25·13 | 100·5 | .. | .. | .. | .. | .. | .. | Barley, .. | 3 | 1·37 | 21 | ·196 | ·196 |
| | | | | | | | | | | | | | | Guchana, .. | 5 | 1·37 | | | | | | | | | Guchana, .. | 3 | 1·37 | 21 | ·196 | ·196 |
| | | | | | | | | | | | | | | Wheat, .. | 5 | 2·56 | | | | | | | | | Wheat, .. | 3 | 2·56 | 34·5 | ·222 | ·222 |
| 291 | „ .. | 1 | 1 | 4·725 | 46 | 52 | 49 | „ .. | .. | .. | .. | .. | .. | Barley, Gram, | 3 | 6·59 | 19·8 | 109 | .. | .. | .. | .. | .. | .. | Barley, Gram, | 1 | 6·59 | 41 | ·160 | ·160 |
| 294 | „ .. | 1 | 1 | .. | .. | 48 | .. | „ .. | .. | .. | .. | .. | .. | Barley, .. | 4 | 1·54 | 14·66 | 102 | .. | .. | .. | .. | .. | .. | Barley, .. | 2 | 1·50 | 20 | ·154 | ·154 |
| | | | | | | | | | | | | | | Wheat, .. | 5 | 1·70 | | | | | | | | | Wheat, .. | 2·7 | 1·70 | 35 | ·131 | ·131 |
| 296 | Kili, 3*p*, .. | 2 | 2 | .. | 45 | 47 | 46 | Dumat, .. | Sugar, .. Cotton, .. Indigo, &c., | .. | .. | .. | .. | Barley, .. | 4 | 3·00 | 85 | 90 | .. | .. | .. | .. | .. | .. | Barley, .. | 2 | 3·00 | 6 | ·333 | ·166 |
| | | | | | | | | | | | | | | Wheat, .. | 5 | 12 07 | | | | | | | | | Wheat, .. | 2·66 | 1·07 | 36 | ·300 | ·150 |
| | | | | | | | | | | | | | | Carrots, Kurr, | 5 | 2·55 | | | | | | | | | Carrots, Kurr, | 4·5 | 2·55 | 15·3 | ·250 | ·125 |
| 300 | Lagor, .. | 1 | 2 | 4·22 | 60 | 65 | 62·5 | „ .. | „ .. | .. | .. | .. | .. | Barley, .. | 3 | 0·73 | 27·8 | 194 | .. | .. | .. | .. | .. | .. | Barley, .. | 2 | ·73 | 8 | ·091 | ·091 |
| | | | | | | | | | | | | | | Wheat, .. | 4 | 5 71 | | | | | | | | | Wheat, .. | 2 | 5 71 | 52 | ·110 | ·110 |
| | | | | | | | | | | | | | | Kurr, Carrots, | 5 | 0 57 | | | | | | | | | Kurr, Carrots, | 4·63 | 0·57 | 14 | ·094 | ·094 |
| 304 | „ .. | 1 | 1 | .. | .. | 60 | .. | „ .. | „ .. | .. | .. | .. | .. | Barley, .. | 2 | 4·07 | 12·28 | 86 | .. | .. | .. | .. | .. | .. | Barley, .. | 2 | 4·07 | 50 | ·163 | ·163 |
| | | | | | | | | | | | | | | Wheat, .. | 3 | 1·38 | | | | | | | | | Wheat, .. | 2 | 1·38 | 16 | ·172 | ·172 |
| 307 | Kili, .. | 2 | 1 | 6·1875 | 65 | 69 | 67 | Dumat and Matyar, | „ .. | .. | .. | .. | .. | Wheat, .. | 4 | 5·61 | 22·44 | 75 | .. | .. | .. | .. | .. | .. | Wheat, .. | 2·2 | 5·61 | 72 | ·173 | ·086 |
| | „ .. | 2 | 1 | 5·4 | 65 | 69 | 67 | „ .. | „ .. | .. | .. | .. | .. | Barley, .. | 2 | 5·71 | 18·02 | 69 | .. | .. | .. | .. | .. | .. | Barley, .. | 2 | 5·71 | 74 | ·140 | ·070 |
| | | | | | | | | | | | | | | Wheat, .. | 3 | 2 20 | | | | | | | | | Wheat, .. | 2 | 2·20 | 28 | ·157 | ·078 |
| 312 | „ .. | 1 | 1 | 4·95 | 56 | 60 | 58 | Sandy, .. Dumat, .. | „ .. | .. | .. | .. | .. | Wheat, .. | 4 | 4·2 | 17·1 | 114 | .. | .. | .. | .. | .. | .. | Wheat, .. | 2 | 4 2 | 62 5 | ·134 | ·134 |
| | | | | | | | | | | | | | | Garden, .. | 10 | 0·03 | | | | | | | | | Garden, .. | 10 | 0·03 | 2·5 | ·120 | ·120 |
| 315 | „ .. | 2 | 1 | 6·1875 | 56 | 61 | 58·5 | „ .. | „ .. | .. | .. | .. | .. | Gujai, .. | 4 | 1·10 | 7·75 | 26 | .. | .. | .. | .. | .. | .. | Gujai, .. | 4 | 1·10 | 24 | ·183 | ·091 |
| | | | | | | | | | | | | | | Wheat, .. | 5 | ·63 | | | | | | | | | Wheat, .. | 3 | 0·63 | 12 | ·157 | 078 |
| | | | | | | | | | | | | | | Garden, .. | 10 | ·02 | | | | | | | | | Garden, .. | 3 | 0·02 | 15 | ·120 | ·060 |
| 319 | „ .. | 1 | 2 | 5·4 | 57 | 62 | 59·5 | „ .. | „ .. | .. | .. | .. | .. | Barley, .. | 3 | 2·73 | 380 | 182 | .. | .. | .. | .. | .. | .. | Barley, .. | 2 | 2·73 | 18 | ·151 | ·151 |
| | | | | | | | | | | | | | | „ & Peas, | 3 | 1·06 | | | | | | | | | „ & Peas, | 3 | 1·06 | 15 | ·106 | ·106 |
| | | | | | | | | | | | | | | Wheat, .. | 5 | 4·72 | | | | | | | | | Wheat, .. | 3 | 4·72 | 66 | ·107 | ·107 |
| | | | | | | | | | | | | | | Carrots & Kurr, | 6 | 0 64 | | | | | | | | | Carrots & Kurr, | 6 | 0·64 | 15 | ·128 | ·128 |
| | | | | | | | | | | | | | | Garden, .. | 10 | 0·02 | | | | | | | | | Garden, .. | 8 | 0·02 | 0·4 | ·200 | ·200 |

TABLE A.—*Observation and Experiment*—(Continued).

| Serial Number. | EXPERIMENTAL. WORK. Duration of work, minutes. | No. of lifts. | Cubic feet lifted. Per pair of cattle per hour. | Per lift, per hour. | Total per well. | H. P. Per bullock. | Total per well. | Length of watercourse. | Area Irrigated. Crop. | Watering. | Interval. | Area in square feet. | Depth. On area. | Of damp. | Days to an Acre. Per pair of cattle. | Per lift. | Per well. | Duty per pair. | COST. Annual. Interest at 5 p. c. | Repairs, &c. | Total. | Per Acre. Per acre irrigated. | Lifting. | Total. | Remarks. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 92 | 93 | 94 | 95 | 96 | 97 | 98 | 99 | 100 | 101 | 102 | 103 | 104 | 105 | 106 | 107 | 108 | 109 | 110 | 111 | 112 | 113 | 114 | 115 | 116 |
| 279 | 460 | 400 | 150 | 300 | 2,295 | 1·380 | 634 | 600 | Carrots, .. | 3 | 20 days, | 15,207 | ·15 | ·70 | 5·8 | 2·9 | 2·9 | .. | 15·1 | 10·0 | 25·1 | | | | |
| 283 | .. | .. | .. | .. | .. | .. | .. | .. | Rabi, .. | *x* | *x* | 12,000 | .. | .. | 7·2 | 3·6 | 3·6 | .. | 0·3 | 10·0 | 10·3 | | | | |
| 287 | 460 | 194 | 193 | 193 | 1,484 | 2·607 | 1,200 | 194<br>100 | Guchana, ..<br>Wheat, .. | 4<br>4 | 30 days,<br>30 days, | 8,803<br>2,234 | ·134<br>·134 | 1·0<br>·66 | 4 | 4 | 4 | .. | 10·2 | 11·0 | 21·2 | | | | |
| 291 | 552 | 394 | 202 | 202 | 1,862 | 2·746 | 1,516 | 520 | Barley, .. | 1 | .. | 7,811 | ·238 | ·90 | 5·5 | 5·5 | 5·5 | .. | 10·2 | 9·0 | 19·2 | | | | |
| 294 | .. | .. | .. | .. | .. | .. | .. | *x* | Wheat, .. | 3 | .. | 6,220 | .. | .. | 7 | 7 | 7 | .. | 10·2 | 9·0 | 19·2 | | | | |
| 296 | .. | .. | .. | .. | .. | .. | .. | 450 | Wheat, .. | 3 | .. | 41,400 | .. | ·80 | 6·3 | 3·15 | 1·05 | .. | 20 | 17·0 | 37·3 | | | | |
| 300 | 460 | 371 | 102 | 102 | 1,565 | 1·773 | 815 | 1,020 | Wheat, .. | 2 | 67 days, | 6,336 | ·248 | ·70 | 1·4 | 14 | 7 | .. | 20·3 | 19·0 | 39·3 | | | | |
| 304 | .. | .. | .. | .. | .. | .. | .. | 500 | Barley, .. | 2 | .. | 6,120 | .. | ·66 | 7 | 7 | 7 | .. | 0·4 | 10·0 | 10·4 | | | | |
| 307 | 445 | 291 | 122 | 243 | 1,800 | 2·188 | 974 | 500 | Wheat, .. | 3 | 45 days, | 13,024 | ·138 | ·50 | 6·7 | 3·34 | 3·34 | .. | 50·4 | 19·0 | 69·4 | | | | |
| 312 | 510 | 231 | 74 | 147 | 1,247 | 1·330 | 678 | 570 | Wheat, .. | 3 | 45 days, | 10,047 | ·124 | ·66 | 8·7 | 4·33 | 4·33 | | | | | | | | |
| | 525 | 231 | 131 | 131 | 1,143 | 2·070 | 1·087 | 120<br>30 | Wheat, ..<br>Garden, .. | 2<br>10 | 60 days,<br>*x* | 5,684<br>820 | ·176 | 1·10 | 6·7 | 6·7 | 6·7 | .. | 15·1 | 18·0 | 33·1 | | | | |
| 315 | 550 | 303 | 102 | 204 | 1,875 | 1·622 | 892 | 470<br>210 | Gujai, ..<br>Wheat, .. | 4<br>4 | 30 days,<br>30 days, | 7,185<br>5,540 | ·149 | ·80<br>120 | 6·8 | 3·4 | 3·4 | .. | 0·4 | 11·0 | 11·4 | | | | |
| 319 | 610 | 461 | 122 | 122 | 2,490 | 2·000 | 1,212 | 940 | Wheat, .. | 4 | 30 days, | 8,926 | ·279 | ·80 | 9·6 | 9·6 | 4·8 | .. | 20·2 | 19·0 | 39·2 | | | | |

TABLE A.—*Observation and Experiment*—(Continued).

STATISTICAL.

| Serial Number. | Locality. Province. | Locality. District. | Locality. Pergunna. | Locality. Village. | Year. | Area in Acres. Actual area in acres. | Area in Acres. Percentage uncultivated. Waste. | Area in Acres. Percentage uncultivated. Culturable. | Cultivated Area. Percentage of actual area cultivated. | Cultivated Area. Double cropped area in acres. | Cultivated Area. Total area actually cultivated in the year. | Percentage of Total Cultivated Area. Wet. | Percentage of Total Cultivated Area. Dry. | Kharif. Wet. Wells. | Kharif. Wet. Canals. | Kharif. Wet. Other sources. | Kharif. Dry. | Kharif. Total. | Rabi. Wet. Wells. | Rabi. Wet. Canals. | Rabi. Wet. Other sources. | Rabi. Dry. | Rabi. Total. | Irrigation Wells. Lime masonry. | Irrigation Wells. Dry bricks. | Irrigation Wells. Kucha. | Irrigation Wells. Total. | Lifts. Leather bucket. | Lifts. Earthen pots. | Lifts. Total. | Usual labor for lifting buckets. | Average area per lift in acres. Kharif. | Average area per lift in acres. Rabi. | Average area per lift in acres. Total. | Remarks. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 |
| | | | | | 1879-80 | 513·45 | 6·5 | 6·4 | 87·1 | 10·70 | 457·37 | 35·7 | 64·3 | .. | .. | .. | 61·4 | 61·4 | 35·7 | .. | .. | 2·9 | 38·6 | 2 *p*-4 | .. | 2 *p*-1<br>1 *p*-33 | 38 | 43 | .. | 43 | .. | .. | 3·83 | 3·82 | W. S. fallen 15'. |
| | | | | | 80-81 | 513·46 | 6·5 | 6·6 | 86·9 | 21·49 | 467·07 | 44·1 | 55·9 | 14·5 | .. | .. | 47·0 | 61·5 | 29·6 | .. | .. | 8·9 | 38·5 | 2 *p*-4 | .. | 2 *p*-5<br>1 *p*-31 | 40 | 49 | .. | 49 | .. | 1·39 | 2·82 | 4·21 | „ „ |
| 329 | | Dibai, .. | | Bajutpur, .. | 79-80 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | |
| | | „ .. | | „ .. | 80-81 | 449·22 | 4·9 | 0·9 | 94·2 | 11·0 | 434·4 | 16·7 | 83·3 | .. | 0·2 | .. | 40·8 | 41·0 | 1·1 | 15·4 | .. | 42·5 | 59·0 | .. | .. | 2 *p*-1<br>1 *p*-2 | 3 | 4 | .. | 4 | .. | .. | 1·21 | 1·21 | Kucha wells do not require any lining. |
| 334 | | Anúpshahr, .. | | Anúpshahr, .. | 79-80 | 1761·88 | 38·8 | 10·6 | 50·6 | 84·5 | 976·15 | 14·4 | 85·6 | 2·6 | 1·6 | 0·25 | 62·4 | 66·85 | 5·5 | 4·4 | 0·05 | 23·2 | 33·15 | 3 *p*-1<br>1 *p*-41 | ..<br>1 *p*-4 | 12 | 58 | 32 | 12 | 44 | .. | 0·80 | 1·42 | 2·22 | |
| | | „ .. | | „ .. | 80-81 | 1761·88 | 38·7 | 14·4 | 46·9 | 104·72 | 929·78 | 20·2 | 79·8 | 5·8 | 2·19 | .. | 52·5 | 60·49 | 6·8 | 5·4 | 0·01 | 27·3 | 39·51 | 3 *p*-1<br>1 *p*-41 | ..<br>1 *p*-4 | ..<br>16 | ..<br>62 | ..<br>32 | ..<br>16 | ..<br>48 | Men,<br>Cattle,<br>Men, | ..<br>1·71<br>.. | 0·73<br>1·69<br>0·60 | 0·73<br>3·40<br>0·60 | |
| 346 | N. W. P. | Bulandshahr. „ .. | | Gynah, .. | 79-80 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | |
| | | „ .. | | „ .. | 80-81 | 1296·75 | 6·3 | 21·7 | 72·0 | 98 | 10·31 | 33·7 | 66·3 | 9·7 | .. | .. | 37·0 | 46·7 | 24·0 | .. | .. | 29·3 | 43·3 | 8 *p*-1<br>4 *p*-1<br>2 *p*-2 | ..<br>..<br>2 *p*-2 | 2 *p*-6<br>1 *p*-2 | 14 | 34 | .. | 34 | Bullock, | 2·93 | 7·27 | 10·20 | 2 pairs of cattle per lift generally used. |
| 353 | | Burna, .. | | Chándpur, .. | 79-80 | 701·8 | 15·9 | 5·9 | 78·2 | 253·8 | 802·11 | 53·2 | 46·8 | 2·0 | 16·2 | .. | 25·9 | 44·1 | 19·7 | 15·2 | 0·10 | 20·9 | 55·9 | 3 *p*-1 | .. | 2 *p*-6 | 20 | 28 | .. | 28 | „ | 0·58 | 5·64 | 6·22 | W. S. has risen 6' since canal was opened. |
| | | „ .. | | „ .. | 80-81 | 701·8 | 15·7 | 5·7 | 78·6 | 228·75 | 779·72 | 70·7 | 29·3 | 12·0 | 13·4 | 0·10 | 20·9 | 46·4 | 26·5 | 18·7 | .. | 8·4 | 53·6 | 3 *p*-1 | ..<br>.. | 1 *p*-13<br>2 *p*-6<br>1 *p*-13 | 20 | 28 | .. | 28 | „ | 3·27 | 7·39 | 10·66 | 2 pairs cattle used. |
| 359 | | „ .. | | Taturpur, .. | 79-80 | 332·0 | 5·7 | 5·5 | 88·8 | 71·41 | 365·85 | 40·9 | 59·1 | 16·6 | .. | .. | 26·6 | 43·2 | 24·3 | .. | .. | 32·5 | 56·8 | .. | .. | 2 *p*-1<br>1 *p*-11 | 12 | 13 | .. | 13 | „ | 4·68 | 6·81 | 11·49 | 2 pairs of cattle per lift generally used. |
| | | „ .. | | „ .. | 80-81 | 332·0 | 6·1 | 1·4 | 92·5 | 88·37 | 395·37 | 53·6 | 46·4 | 19·1 | .. | .. | 22·5 | 41·6 | 34·2 | .. | 0·3 | 23·9 | 58·4 | .. | .. | 2 *p*-3<br>1 *p*-14 | .. | .. | .. | .. | „ | .. | .. | 10·52 | |

TABLE A.—*Observation and Experiment*—(Continued).

| Serial Number. | Date. Day. | Date. Month. | Date. Year. | Number of Well. | Class. | Cost. Construction. | Cost. Fittings. | Cost. Total. | Cost. Renewal. | Cost. Lifts. | Cost. Yearly repairs. | Cost. Total. | Supply. | Quality. | Substratum. | Cultivators on well. Number. | Cultivators on well. Caste. | Labor and cost per day in annas. Men, home. | Do. hired. | Rate, per day. | Cattle. | Cost for men. | Do. for cattle. | Total cost, per day. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DESCRIPTIVE. | | | | | | | | | | | | | | | | | | | | | | | | |
| 37 | 38 | 39 | 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 | 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 | 61 |
| 325 | 8 | 2 | 82 | 8,445 | Kucha lined, .. | 11/- | 6/- | 17/- | .. | 7/- | 1/- | 15/- | Spring, .. | Sweet, .. | Clay, .. | 1 | Jat, .. | 1 | 2 | 1·5 | 4 | 3 | 6 | -/9/- |
| 329 | 13 | 2 | 82 | 118 | Kucha unlined, .. | 8/- | 3/- | 22/- | .. | 7/- | 1/- | 15/- | „ .. | „ .. | „ 42′, | 1 | Thakur, .. | 3 | .. | .. | 4 | 4 | 12 | 1/- |
| | | | | 118 | „ „ .. | 8/- | 3/- | | | | | | | | | 2 | Lodhas, .. | 3 | .. | .. | 4 | .. | .. | |
| 334 | 14 | 2 | 82 | 768 | Masonry, .. | 250/- | 3/- | 253/- | .. | 7/- | 1/- | 8/- | „ .. | „ .. | „ .. | 1 | Mali, .. | 3 | .. | .. | 2 | 2 | 3 | -/5/- |
| 340 | 14 | 2 | 82 | 1,088 | „ .. | 300/- | 9/- | 309/- | .. | 7/- | 1/- | 22/- | „ .. | „ .. | „ 39′, .. | 1 | Mali, .. | 3 | 1 | 1·5 | 8 | 3·5 | 12 | -/15/6 |
| | | | | | | | | | | | | | | | | 1 | Musalman, .. | .. | 3 | 1·5 | 2 | 4·5 | 3 | -/7/6 |
| 346 | 15 | 2 | 82 | 510 | „ .. | 300/- | 10/- | 310/- | .. | 8/- | 1/- | 25/- | „ .. | „ .. | „ 30′, | 1 | Barber, | 3 | .. | .. | 4 | 2 | 6 | -/8/- |
| | | | | | | | | | | | | | | | | 1 | Bania, | | | | | | | |
| | | | | | | | | | | | | | | | | 3 | Brahmins, | | | | | | | |
| | | | | | | | | | | | | | | | | 9 | Jats, | | | | | | | |
| 353 | 16 | 2 | 82 | 153 | Kucha lined with wood, .. | 37/- | 3/- | 40/- | .. | 8/- | 2/- | 10/- | „ .. | „ .. | „ 27′, .. | 9 | Lodhas, .. | 3 | .. | .. | 4 | 2 | 6 | -/8/- |
| 359 | 20 | 2 | 82 | 234 | „ .. | 24/- | 6/- | 30/- | 3/- | 11/- | 1/- | 26/- | „ .. | „ .. | „ | 1 | Barber, | 3 | 2 | 1·5 | 8 | 5 | 12 | 1/1/- |
| | | | | | | | | | | | | | | | | 2 | Jats, | | | | | | | |
| | | | | | | | | | | | | | | | | 6 | Brahmins, | | | | | | | |

TABLE A.—*Observation and Experiment*—(Continued).

EXPERIMENTAL.

| Serial Number. | Run. Class. | Run. Pairs of cattle to each lift. | Lift. Number. | Lift. Content in cubic feet. | Depth to Wells. Morning. | Depth to Wells. Evening. | Depth to Wells. Mean. | Soil. | COMMAND. *Kharif* 1881-82. Crop. | Waterings required. | Area. | Total area reduced to one watering. | No. of days to area. | COMMAND. *Rabi* 1881-82. Crop. | Waterings required. | Area. | Total area reduced to one watering. | No. of days to area. | AREA IRRIGATED TO DATE. *Kharif* 1881-82. Crop. | Waterings given. | Area. | Working days to date. | Duty. Per lift. | Duty. Per pair. | *Rabi* 1881-82. Crop. | Waterings given. | Area. | Working days to date. | Duty. Per lift. | Duty. Per pair. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 62 | 63 | 64 | 65 | 66 | 67 | 68 | 69 | 70 | 71 | 72 | 73 | 74 | 75 | 76 | 77 | 78 | 79 | 80 | 81 | 82 | 83 | 84 | 85 | 86 | 87 | 88 | 89 | 90 | 91 |
| 325 | Kili, .. | 1 | 2 | 4·89 | 56 | 62 | 59 | Sandy, .. Dumat, .. | .. | .. | .. | .. | .. | Barley, .. | 2 | 0·32 | 217 | 56 | .. | .. | .. | .. | .. | .. | Barley, .. | 1 | 0·32 | 2 | ·080 | ·080 |
| | | | | | | | | | | | | | | „ & Peas, | 2 | 9·46 | | | | | | | | | „ & Peas, | 1·17 | 9·46 | 63 | ·080 | ·080 |
| | | | | | | | | | | | | | | Gujai, .. | 3 | 0·71 | | | | | | | | | Gujai, .. | 2 | 0·7 | 5 | ·142 | ·142 |
| 329 | „ .. | 2 | 1 | .. | 30 | .. | .. | „ .. | .. | .. | .. | .. | .. | Barley, Peas, .. | 2 | 3·56 | 39 | 101 | .. | .. | .. | .. | .. | .. | Barley, Peas, | 1·56 | 3·53 | 10 | ·277 | ·138 |
| | „ .. | 2 | 1 | .. | 30 | .. | .. | „ .. | | | | | | Guchana, .. | 3 | 2·25 | | | | | | | | | Guchana, .. | 2 | 2·25 | 10 | ·225 | ·112 |
| | | | | | | | | | | | | | | Gujai, .. | 3 | 3·65 | | | | | | | | | Gujai, .. | 1 | 3·65 | 10 | ·182 | ·091 |
| | | | | | | | | | | | | | | Wheat, .. | 4 | 3·56 | | | | | | | | | Wheat, .. | 2 | 3·56 | 20 | ·178 | ·089 |
| 334 | „ .. | 1 | 1 | .. | 37 | 41 | 39 | „ .. | .. | .. | .. | .. | .. | Gujai, .. | 2 | 1·347 | 14 | 66 | .. | .. | .. | .. | .. | .. | Gujai, .. | 1 | 1·347 | 18 | 0·212 | 0·212 |
| | | | | | | | | | | | | | | Tobacco, .. | 4 | 0·625 | | | | | | | | | Tobacco, .. | 2 | 0·625 | | | |
| | | | | | | | | | | | | | | Cauliflour, .. | 7 | 0·031 | | | | | | | | | Cauliflour, | 4 | 0·031 | | | |
| | | | | | | | | | | | | | | Egg plant, .. | 7 | 0·156 | | | | | | | | | Egg plant, | 7 | 0·156 | | | |
| | | | | | | | | | | | | | | Melons, .. | 8 | 0·937 | | | | | | | | | Melons, .. | .. | .. | | | |
| 340 | „ .. | 2 | 2 | .. | 34 | .. | .. | „ .. | Cotton, .. | 1 | 1·31 | 4·16 | 11·25 | Wheat, .. | 6 | 5·06 | 75·6 | 113 | Cotton, .. | 1 | 1·31 | 2·5 | 0·265 | 0·132 | Wheat, .. | 4 | 5·06 | 51 | ·200 | ·100 |
| | | | | | | | | | Sugar, .. | 4 | 0·48 | | | Oats, .. | 6 | 0·22 | | | Sugar, .. | 4 | 0·48 | 5 | 0·192 | 0·096 | Oats, .. | 3 | 0·22 | 1·5 | ·330 | ·165 |
| | | | | | | | | | | | | | | Garden, .. | 10 | 3·37 | | | | | | | | | Garden, .. | 5·43 | 3·37 | 43 | ·209 | ·104 |
| | „ .. | 1 | 1 | .. | 34 | .. | .. | „ .. | „ .. | 3 | 0·31 | | | Barley, .. | 5 | 0·48 | | | Sugar, .. | 3 | 0·31 | 3·75 | 0·250 | 0·250 | Barley, .. | 3 | 0·48 | 5·25 | ·274 | ·274 |
| | | | | | | | | | | | | | | Wheat, .. | 6 | 1·105 | | | | | | | | | Wheat, .. | 3 | 1·105 | 12·75 | ·260 | ·260 |
| | | | | | | | | | | | | | | Oats, .. | 6 | 0·20 | | | | | | | | | Oats, .. | 3 | 0·20 | 2·25 | ·266 | ·266 |
| | | | | | | | | | | | | | | Barley, .. | 4 | 3·84 | | | | | | | | | Barley, .. | 2·86 | 3·84 | 2·5 | ·147 | ·073 |
| | | | | | | | | | | | | | | Wheat, .. | 7 | 4·5 | | | | | | | | | Wheat, .. | 3·64 | 4·50 | 40 | ·138 | ·069 |
| 346 | „ 3 *p*, .. | 2 | 1 | 6·0 | 21·5 | 26 | 23·75 | „ .. | Cotton, .. | 3 | 2·2 | 6·6 | 8 | Oats, .. | 7 | 0·07 | 105 | 141 | Cotton, .. | 3 | 2·2 | 12 | ·183 | ·091 | Oats, .. | 3 | 0·07 | ·4 | ·175 | ·087 |
| | | 2 | 2 | .. | .. | .. | .. | | | | | | | Kurr, .. | 3 | 12·00 | | | | | | | | | Kurr, .. | 2 | 12 00 | 5.7 | ·140 | ·070 |
| | | | | | | | | | | | | | | Tobacco, .. | 15 | 1·125 | | | | | | | | | Tobacco, .. | 1·11 | 1·125 | 2·7 | ·155 | ·077 |
| | | | | | | | | | | | | | | Garden, .. | 10 | 0·47 | | | | | | | | | Garden, .. | 6 | 0·47 | 8 | ·120 | ·060 |
| | | | | | | | | | | | | | | Barley, .. | 3 | 2·3 | | | | | | | | | Barley, .. | 2 | 2·3 | 15·5 | ·300 | ·150 |
| | | | | | | | | | | | | | | „ Peas, .. | 3 | 3·47 | | | | | | | | | „ Peas, | 1·53 | 3·47 | 22 | ·241 | ·120 |
| 353 | „ .. | 2 | 1 | .. .. | 14 | .. | .. | „ .. | „ .. | .. | .. | .. | .. | Gujai, .. | 4 | 0·65 | 37 | 148 | .. | .. | .. | .. | .. | .. | Gujai, .. | 2 | 0·65 | 6 | ·216 | ·108 |
| | | | | | | | | | | | | | | Tobacco, .. | 9 | 0·72 | | | | | | | | | Tobacco, .. | 2 | 0 72 | 4 | ·360 | ·108 |
| | | | | | | | | | | | | | | Garden, .. | 7 | 1·875 | | | | | | | | | Garden, .. | 3 | 1 875 | 2·0 | ·281 | ·140 |
| | | | | | | | | | | | | | | Gram, .. | 2 | 2·56 | | | | | | | | | Gram, .. | 2 | 2·56 | 14 | ·183 | ·091 |
| | | | | | | | | | | | | | | Barley, .. | 3 | 0·22 | | | | | | | | | Barley, .. | 2 | 0·22 | 5 | ·440 | ·220 |
| | | | | | | | | | | | | | | „ & Peas, | 3 | 1·56 | | | | | | | | | „ & Peas, | 2 | 1·56 | 5 | ·312 | ·156 |
| | | | | | | | | | | | | | | Gujai .. | 4 | 1·625 | | | | | | | | | Gujai .. | 3 | 1·625 | 7·16 | ·340 | ·170 |
| 359 | „ .. | 2 | 2 | 5·57 | 27 | 27 | 27 | „ .. | „ .. | .. | .. | .. | .. | Wheat, .. | 4 | 5·53 | 84 | 160 | .. | .. | .. | .. | .. | .. | Wheat, .. | 2·45 | 5·53 | 20·14 | ·136 | ·168 |
| | | | | | | | | | | | | | | Guchana, .. | 3 | 2·65 | | | | | | | | | Guchana, .. | 1 | 2·65 | 7 | ·188 | ·094 |
| | | | | | | | | | | | | | | Peas, .. | 2 | 0·56 | | | | | | | | | Peas, .. | 1 | 0·56 | 1 | ·280 | ·140 |
| | | | | | | | | | | | | | | Tobacco, .. | 8 | 3·0 | | | | | | | | | Tobacco, .. | 1 | 3 0 | 3·5 | ·128 | ·214 |
| | | | | | | | | | | | | | | Garden, .. | 7 | 1·65 | | | | | | | | | Garden, .. | 4 | 1·65 | 8 | ·412 | ·206 |

TABLE A.—*Observation and Experiment*—(Continued).

| Serial Number. | EXPERIMENTAL. WORK. Duration of work, minutes. | No. of lifts. | Cubic feet lifted. Per pair of cattle, per hour. | Per lift, per hour. | Total per well. | H. P. Per bullock. | Total per well. | Length of watercourse. | Area Irrigated. Crop. | Watering. | Interval. | Area in square feet. | Depth. On area. | Of damp. | Days to an Acre. Per pair of cattle. | Per lift. | Per well. | Duty per pair. | COST. Annual. Interest at 5 p. c. | Repairs, &c. | Total. | Per Acre. Per acre irrigated. | Lifting. | Total. | Remarks. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 92 | 93 | 94 | 95 | 96 | 97 | 98 | 99 | 100 | 101 | 102 | 103 | 104 | 105 | 106 | 107 | 108 | 109 | 110 | 111 | 112 | 113 | 114 | 115 | 116 |
| 325 | 555 | 532 | 140 | 140 | 2,600 | 2·283 | 1,267 | 550 | Barley, Peas, | 2 | 60 days, | 16,524 | ·157 | 1·2 | 5·2 | 5·2 | 2·6 | .. | 0·8 | 15·0 | 15·8 | | | | |
| 329 | .. | .. | .. | .. | .. | .. | .. | .. | Rabi, .. | 2 | 60 days, | 16,754 | .. | .. | 10·4 | 5·2 | 2·6 | .. | 0·8 | 15·0 | 15·1 | | | | No experiment on account of rainfall. |
| 334 | .. | .. | .. | .. | .. | .. | .. | .. | Garden, .. | x | .. | 9,234 | .. | .. | 4·7 | 4·7 | 4·7 | .. | 12·6 | 8·0 | 20·6 | | | | » » |
| 340 | .. | .. | .. | .. | .. | .. | .. | .. | Rabi, .. | 3 | .. | 18,253 | .. | .. | 9·6 | 4·8 | 1·5 | .. | 15·4 | 22·0 | 37·4 | | | | » » |
| | .. | .. | .. | .. | .. | .. | .. | .. | Rabi, .. | 3 | .. | 11,210 | .. | .. | 4·0 | 4·0 | | | | | | | | | |
| 346 | 400 | 425 | 190 | 380 | 2,550 | 1·271 | 508 | 790 | Tobacco, .. | 1 | .. | 10,700 | ·24 | ·66 | 8·0 | 4 | 1·35 | .. | 15·1 | 25·0 | 40·0 | | | | Only one lift at work as rain had recently fallen. |
| 353 | .. | .. | .. | .. | .. | .. | .. | .. | Rabi, .. | 2 | .. | 10,344 | .. | .. | 8·0 | 4·0 | 4·0 | .. | 2·0 | 10 | 12·0 | | | | |
| 359 | 630 | 620 | 82 | 165 | 3,453 | ·600 | 372 | 810 | Garden, .. | 5 | 25 days, | 22,680 | ·15 | 1·4 | 7·6 | 3·8 | 1·9 | .. | 1·5 | 26 | 27·5 | | | | |

TABLE A.—*Observation and Experiment*—(Continued).

| Serial Number. | Province. | District. | Pergunna. | Village. | Year. | STATISTICAL. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | Remarks. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | *Locality.* | | | | *Area in Acres.* | | | *Cultivated Area.* | | | *Percentage of Total Cultivated Area.* | | | | | | | | | | *Irrigation Wells.* | | | | *Lifts.* | | | Usual labor for lifting buckets. | *Average area per lift, in acres.* | | | |
| | | | | | | | | | | | *Percentage uncultivated.* | | | | | | *Kharif.* | | | | | *Rabi.* | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | *Wet.* | | | | | *Wet.* | | | | | | | | | | | | | | |
| | | | | | | | | | | Actual area in acres. | Waste. | Culturable. | Percentage of actual area cultivated. | Double cropped area in acres. | Total area actually cultivated in the year. | Wet. | Dry. | Wells. | Canals. | Other sources. | Dry. | Total. | Wells. | Canals. | Other sources. | Dry. | Total. | Lime masonry. | Dry bricks. | Kacha. | Total. | Leather bucket. | Earthen pots. | Total. | | Kharif. | Rabi. | Total. | |
| 1 | 2 | 3 | 4 | 5 | 6 | | | | | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 |
| 374 | | | Burna, .. | Jasnauli, .. | 1879-80 | | | | | 711·43 | 9·5 | 7·4 | 83·1 | 21·2 | 611·92 | 1·1 | 98·9 | .. | .. | .. | 42·0 | .. | 1·1 | .. | .. | 56·9 | .. | 3 *p*-1 | 3 *p*-2 | .. | 3 | 6 | .. | 6 | Bullock, | .. | 1·1 | 1·1 | |
| 376 | | | „ .. | „ .. | 80-81 | | | | | 711·43 | 9·5 | 7·4 | 83·1 | 25·25 | 615·97 | 9·8 | 90·2 | 3·6 | .. | 0·7 | 32·9 | .. | 5·2 | .. | 0·3 | 57·3 | .. | 3 *p*-1 | 3 *p*-2 | .. | 3 | 6 | .. | 6 | „ | 3·6 | 5·35 | 8·95 | 2 pairs of cattle per lift generally used. |
| 381 | | | „ .. | Bulandshahr, | 79-80 | | | | | 5179·3 | 8·7 | 22·9 | 68·4 | 1219·9 | 4758·8 | 53·8 | 46·2 | 8·6 | 16·0 | .. | 20·8 | 45·4 | 21·8 | 7·4 | .. | 25·4 | 54·6 | 2 *p*-25<br>1 *p*-18 | ..<br>1 *p*-17 | 2 *p*-26<br>1 *p*-43 | 129 | 180 | .. | 180 | „ | 2·36 | 5·73 | 8·09 | „ „ „ |
| | | | „ .. | „ .. | 80-81 | | | | | 5179·3 | 12·1 | 15·2 | 72·7 | 1955·47 | 5721·47 | 76·2 | 23·8 | 8·4 | 20·2 | 0·02 | 7·3 | 35·92 | 16·5 | 31·08 | .. | 16·5 | 56·08 | 2 *p*-25<br>1 *p*-18 | ..<br>1 *p*-17 | 2 *p*-26<br>1 *p*-43 | 129 | 180 | .. | 180 | „ | 2·68 | 5·27 | 7·95 | „ „ „ |
| 394 | | | Agoutah, .. | Aoleduh, .. | 79-80 | | | | | 1525·0 | 6·2 | 15·9 | 77·9 | 130 | 1,318 | 36·2 | 63·8 | 5·7 | 8·2 | 0·3 | 21·4 | 35·6 | 5·3 | 16·2 | 0·5 | 42·4 | 64·4 | 2 *p*-7<br>1 *p*-15 | .. | .. | 22 | 29 | .. | 29 | „ | 2·6 | 2·4 | 5·0 | „ „ „ |
| | | | „ .. | „ .. | 80-81 | | | | | 1525·0 | 6·3 | 15·4 | 78·3 | 246·75 | 1,445 | 78·9 | 21·1 | 13·6 | 19·6 | 0·4 | 15·7 | 49·3 | 19·0 | 25·8 | 0·5 | 5·4 | 50·7 | 2 *p*-9<br>1 *p*-10 | .. | .. | 19 | 28 | .. | 28 | „ | 7·0 | 9·72 | 16·72 | „ „ „<br>W. S. raised 3′ since Canal was opened. |
| 406 | | | Hapur, .. | Hapur, .. | 79-80<br>80-81 | | | | | 2564·0<br>2564·0 | 15·3 | 22·9 | 61·8 | 320·78 | 1,905 | 22·9 | 77·1 | 0·2 | .. | .. | 48·7 | 48·9 | 22·5 | .. | 0·2 | 28·4 | 51·1 | 2 *p*-3 | .. | 2 *p*-2 | 185 | 125 | .. | 125 | „ | 0·02 | 3·41 | 3·43 | |

N. W. P. — MEERUT. — BULANDSHAHR.

TABLE A.—*Observation and Experiment*—(Continued).

| DESCRIPTIVE. | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Serial Number. | *Date.* | | | Number of Well. | *Class.* | *Cost.* | | | | | | | *Supply.* | *Quality.* | *Substratum.* | *Cultivators on well.* | | *Labor and cost per day in annas.* | | | | | | | |
| | Day. | Month. | Year. | | | Construction. | Fittings. | Total. | Renewal. | Lifts. | Yearly repairs. | Total. | | | | Number. | Caste. | Men, home. | Do. hired. | Rate, per day. | Cattle. | Cost for men. | Do. for cattle. | Total cost, per day. | | |
| 37 | 38 | 39 | 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 | 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 | 61 | | |
| 369 | 20 | 2 | 82 | 245 | Kucha unlined,.. | 5·5 | 3/- | 8·5 | 5·5 | 8/- | .. | 135/- | Spring, .. | Sweet, .. | Clay, .. | 1<br>1 | Musalman,<br>Brahmin, | 1 | 2 | 2·0 | 4 | 4 | 6 | -/10/- | | |
| 374 | 21 | 2 | 82 | 193 | Masonry, .. | 300/- | 6/- | 306/- | .. | 7/- | 1/- | 15/- | „ .. | „ .. | „ .. | 12<br>2 | Jats,<br>Chamars, | 4 | 2 | 1·5 | 8 | 6 | 12 | 1/2/- | | |
| 381 | 22 | 2 | 82 | 137 | Kucha, lined with wood, .. | 32/- | 3/- | 35/- | .. | 9/- | 1/- | 10/- | „ .. | „ .. | „ | 1 | Lodha, .. | 2 | 1 | 1·5 | 4 | 2·5 | 6 | -/8/6 | | |
| 386 | 22 | 2 | 82 | 354 | „ „ .. | 32/- | 3/- | 35/- | .. | 9/- | 1/- | 10/- | „ .. | „ .. | „ .. | 3 | Lodhas, .. | 3 | 1 | 1·0 | 4 | 2 | 6 | -/8/- | | |
| 389 | 24 | 2 | 82 | 2,300 | Masonry, old, .. | 250/- | 6/- | 256/- | .. | 9/- | 1/- | 19/- | „ .. | „ .. | „ .. | 3<br>1 | Lodhas,<br>Musalman, | 3 | 2 | 1·5 | 8 | 5 | 12 | 1/1/- | | |
| 394 | 25 | 2 | 82 | 1,244 | „ 8 years, | 200/- | 3/- | 203/- | .. | 10/- | 1/- | 11/- | „ .. | „ .. | „ 38', .. | 12 | Ahirs, .. | 4 | .. | .. | 4 | 3 | 6 | -/9/- | | |
| 400 | 25 | 2 | 82 | 1,094 | Masonry, old, .. | 200/- | 3/- | 203/- | .. | 9/- | 1/- | 10/- | „ .. | „ .. | „ .. | 13 | Ahirs, .. | 3 | .. | .. | 4 | 2 | 6 | -/8/- | | |
| 406 | 26 | 2 | 82 | 1,459 | Kucha unlined,.. | 5/- | 5/- | 10/- | 1/- | 9/- | 1/- | 11/- | „ .. | „ .. | „ 20', .. | 4 | Thaggas, .. | 3 | 1 | 2·0 | 4 | 4 | 6 | -/10/- | | |
| 410 | 26 | 2 | 82 | 1,584 | Kucha, lined with wood, .. | 16/- | 5/- | 21/- | .. | 9/- | 1/- | 10/- | „ .. | „ .. | „ 20', .. | .. | .. | .. | 1<br>1<br>1<br>1 | 1·5<br>1·0<br>0·75<br>0·5 | 4 | 3·75 | 6 | .. | | |
| 412 | .. | .. | .. | 1,584 | Masonry, 4 years, | 123/- | 5/- | 130/- | .. | 9/- | 1/- | 10/- | „ .. | „ .. | „ .. | 6 | „ .. | .. | 1<br>2 | 1·0<br>0·5 | 4 | 2·0 | 6 | 1 *p*·3 | | |
| 414 | .. | .. | .. | 1,593 | „ „ .. | 175/- | 5/- | 180/- | .. | 9/- | 1/- | 19/- | „ .. | „ .. | „ .. | .. | „ .. | 2 | 1<br>1 | 1·0<br>0·5 | 4 | 2·5 | 6 | .. | | |

( x )

TABLE A.—*Observation and Experiment*—(Continued).

EXPERIMENTAL.

| Serial Number. | Run. Class. | Run. Pairs of cattle to each lift. | Lift. Number. | Lift. Content in cubic feet. | Depth to Wells. Morning. | Depth to Wells. Evening. | Depth to Wells. Mean. | Soil. | COMMAND. *Kharif* 1881-82. Crop. | Wateringsrequired. | Area. | Total area reduced to one watering. | No. of days to area. | COMMAND. *Rabi* 1881-82. Crop. | Wateringsrequired. | Area. | Total area reduced to one watering. | No. of days to area. | AREA IRRIGATED TO DATE. *Kharif* 1881-82. Crop. | Wateringsgiven. | Area. | Working days to date. | Duty. Per lift. | Duty. Per pair. | *Rabi* 1881-82. Crop. | Wateringsgiven. | Area. | Working days to date. | Duty. Per lift. | Duty. Per pair. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 62 | 63 | 64 | 65 | 66 | 67 | 68 | 69 | 70 | 71 | 72 | 73 | 74 | 75 | 76 | 77 | 78 | 79 | 80 | 81 | 82 | 85 | 84 | 85 | 86 | 87 | 88 | 89 | 90 | 91 |
| 369 | Kili, .. | 2 | 1 | 5·70 | 27 | 28 | 27·5 | Dumat, .. | Cotton, .. | .. | .. | .. | .. | Barley, .. | 3 | ·06 | 22 | 48 | Cotton, .. | .. | .. | .. | .. | .. | Barley, .. | 2 | 1·06 | ·36 | ·333 | ·166 |
| | | | | | | | | | | | | | | Wheat, .. | 4 | 2·09 | | | | | | | | | Wheat, .. | 3 | 2·09 | 17·5 | ·356 | ·178 |
| | | | | | | | | | | | | | | Tobacco, .. | 8 | 1·15 | | | | | | | | | Tobacco, .. | 2 | 1·15 | 8 | ·300 | ·150 |
| | | | | | | | | | | | | | | Garden, .. | 7 | 0·62 | | | | | | | | | Garden, .. | 3 | 0·62 | 6 | ·310 | ·155 |
| | | | | | | | | | | | | | | Gram, .. | 2 | 1·34 | | | | | | | | | Gram, .. | 1 | 1·34 | 4 | ·112 | ·056 |
| 374 | „ 3-*p*, .. | 2 | 2 | 3·74 | 27 | 33 | 30 | „ .. | „ .. | .. | .. | .. | .. | Barley, .. | 3 | 11·4 | 111 | *271 | „ .. | .. | .. | .. | .. | .. | Barley, .. | 1·54 | 11·4 | 38·5 | ·170 | ·085 |
| | | | | | | | | | | | | | | Guchana, .. | 4 | 1·78 | | | | | | | | | Guchana, .. | 1 | 1·78 | 4·5 | ·132 | ·066 |
| | | | | | | | | | | | | | | Wheat, .. | 4 | 10·6 | | | | | | | | | Wheat, .. | 1·27 | 10·6 | 32 | ·141 | ·070 |
| | | | | | | | | | | | | | | Peas, .. | 2 | 0·5 | | | | | | | | | Peas, .. | 1 | 0·5 | 1·5 | ·111 | ·055 |
| | | | | | | | | | | | | | | Tobacco, .. | 8 | 3·0 | | | | | | | | | Tobacco, .. | 1·37 | 3·0 | 9 | ·155 | ·077 |
| | | | | | | | | | | | | | | Peas, .. | 2 | 1·7 | | | | | | | | | Peas, .. | 1 | 1·7 | 5·25 | ·223 | ·162 |
| 381 | „ .. | 2 | 1 | 5·74 | 14·3 | 21·7 | 18 | „ II, .. | „ .. | .. | .. | .. | .. | Gujai, .. | 4 | 2·12 | 24 | 132 | „ .. | .. | .. | .. | .. | .. | Gujai, .. | 2 | 2·12 | 14 | ·103 | ·151 |
| | | | | | | | | | | | | | | Wheat, .. | 4 | 2·56 | | | | | | | | | Wheat, .. | 2 | 2·56 | 18·5 | ·180 | ·140 |
| | | | | | | | | | | | | | | Garden, .. | 7 | 0·31 | | | | | | | | | Garden, .. | 1 | 0·31 | 1 | ·110 | ·155 |
| 386 | „ .. | 2 | 1 | 5·34 | 12·5 | 19·5 | 16 | „ I, .. | „ .. | .. | .. | .. | .. | Wheat, .. | 4 | 0·875 | 28 | 81 | „ .. | .. | .. | .. | .. | .. | Wheat, .. | 3 | 0·875 | 9 | ·192 | ·146 |
| | | | | | | | | | | | | | | Garden, .. | 7 | 3·47 | | | | | | | | | Garden, .. | 3 | 3·47 | 30 | ·347 | ·173 |
| | | | | | | | | | | | | | | Barley, Peas, .. | 3 | 5·09 | | | | | | | | | Barley, Peas, | 2·14 | 5·09 | 22·75 | ·240 | ·120 |
| 389 | „ .. | 2 | 2 | 5·29 | 22 | 30 | 26 | „ .. | „ .. | .. | .. | .. | .. | Wheat, .. | 4 | 4·81 | 76·5 | 145 | „ .. | .. | .. | .. | .. | .. | Wheat, .. | 2·2 | 4·81 | 28·0 | ·188 | ·094 |
| | | | | | | | | | | | | | | Kurr, .. | 3 | 5·61 | | | | | | | | | Kurr, .. | 1·24 | 5·61 | 16·0 | ·232 | ·116 |
| | | | | | | | | | | | | | | Garden, .. | 7 | 3·03 | | | | | | | | | Garden, .. | 3·58 | 3·03 | 23·0 | ·236 | ·118 |
| | | | | | | | | | | | | | | Barley, .. | 3 | 1·57 | | | | | | | | | Barley, .. | 2 | 1·57 | 8 | ·392 | ·196 |
| | | | | | | | | | | | | | | Barley, Peas, .. | 3 | 3·357 | | | | | | | | | Barley, Peas, | 2 | 3·357 | 25 | ·120 | ·135 |
| 394 | „ .. | 2 | 1 | 6·525 | 15 | 16 | 15·5 | Matyar, .. | „ .. | .. | .. | .. | .. | Gujai, .. | 4 | 0·875 | 44 | 127 | „ .. | .. | .. | .. | .. | .. | Gujai, .. | 2 | 0·875 | 5 | ·310 | ·175 |
| | | | | | | | | | | | | | | Wheat, .. | 4 | 5·375 | | | | | | | | | Wheat, .. | 2 | 5·375 | 25 | ·430 | ·215 |
| | | | | | | | | | | | | | | Garden, .. | 6 | 0·657 | | | | | | | | | Garden, .. | 3 | 0·657 | 3 | ·617 | ·319 |
| | | | | | | | | | | | | | | Barley, .. | 3 | 0·13 | | | | | | | | | Barley, .. | 2 | 0·13 | ·75 | ·346 | ·173 |
| | | | | | | | | | | | | | | Barley, Peas, .. | 3 | 2·7 | | | | | | | | | Barley, Peas, | 2 | 2·7 | 15·5 | ·348 | ·174 |
| 400 | „ .. | 2 | 1 | 5·625 | 15 | 18 | 16·5 | „ .. | Sugar, .. | 4 | 2·8 | 12·4 | 45 | Guchana, .. | 4 | 0·956 | 30 | 109 | Sugar, .. | †1 | 2·8 | 7 | ·400 | ·200 | Guchana, .. | 2 | 0·956 | 5 | ·382 | ·191 |
| | | | | | | | | | Cotton, .. | 1 | 1·2 | | | Wheat, .. | 4 | 4·12 | | | Cotton, .. | 1 | 1·2 | 3·5 | ·343 | ·171 | Wheat, .. | 2 | 4·12 | 22 | ·374 | ·187 |
| | | | | | | | | | | | | | | Tobacco, .. | 8 | 0·2 | | | | | | | | | Tobacco, .. | 1 | 0·2 | ·75 | ·266 | ·133 |
| | | | | | | | | | | | | | | Barley, Peas, .. | 2 | 0·23 | | | | | | | | | Barley, Peas, | 1 | 0·23 | 1·5 | ·153 | ·076 |
| 406 | „ .. | 2 | 1 | 5 85 | 21·2 | 24 | 22·6 | Sandy, .. | „ .. | .. | .. | .. | .. | Gujai, .. | 3 | 3·0 | 12 | 150 | „ .. | .. | .. | .. | .. | .. | Gujai, .. | 1·5 | 3·00 | 15 | ·300 | ·150 |
| | | | | | | | | | | | | | | Wheat, .. | 4 | 0·66 | | | | | | | | | Wheat, .. | 3 | 0·66 | 12 | ·165 | ·082 |
| 410 | „ .. | 2 | 1 | 5 4 | 20 | 24 | 22 | „ .. | Cotton, .. | 1 | 2 6 | 2 6 | 2·0 | Barley, Peas, .. | 3 | 1·12 | .. | .. | „ .. | ‡1 | 2·6 | 2·25 | ·300 | ·150 | Barley, Peas, | 3 | 1·12 | 3 | ·373 | ·186 |
| | | | | | | | | | | | | | | Gujai, .. | 3 | 3·8 | | | | | | | | | Gujai, .. | 2·2 | 3·8 | 6 | ·370 | ·185 |
| 412 | „ .. | 2 | 1 | 5·7375 | 25 | 26 4 | 25·7 | „ .. | .. | .. | .. | .. | .. | Wheat, .. | 4 | 15·0 | 87 | 61 | „ .. | .. | .. | .. | .. | .. | Wheat, .. | 2·26 | 15·0 | 31 | ·275 | ·137 |
| | | | | | | | | | | | | | | Oats, .. | 4 | 1·43 | | | | | | | | | Oats, .. | 3 | 1·43 | 2·6 | ·408 | ·204 |
| | | | | | | | | | | | | | | Peas, .. | 2 | 1·25 | | | | | | | | | Peas, .. | 3 | 1·25 | 2·5 | ·375 | ·187 |
| 414 | „ 2 pur, .. | 2 | §1 | 5 9625 | 24 | 24·6 | 24·3 | „ .. | .. | .. | .. | .. | .. | Carrots, Kurr, .. | 5 | 0·20 | .. | .. | .. | .. | .. | .. | .. | .. | Carrots, Kurr, | 5 | 0·2 | 6 | ·400 | ·200 |
| | | | | | | | | | | | | | | Tobacco, .. | 8 | 0·13 | | | | | | | | | Tobacco, .. | 2 | 0·13 | ·25 | ·260 | ·130 |
| | | | | | | | | | | | | | | Garden, .. | 6 | 0·34 | | | | | | | | | Garden, .. | 1 | 0·34 | ·25 | ·340 | ·170 |

* Area small as drinking water was taken from the lifts. † Since rains. ‡ Since rains. § 14 feet to-day.

TABLE A.—*Observation and Experiment*—(Continued).

| Serial Number. | EXPERIMENTAL. WORK. Duration of work, minutes. | No. of lifts. | Cubic feet lifted. Per pair of cattle per hour. | Per lift, per hour. | Total per well. | H. P. Per bullock. | Total per well. | Length of watercourse. | Area Irrigated. Crop. | Watering. | Interval. | Area in square feet. | Depth. On area. | Of damp. | Days to an Acre. Per pair of cattle. | Per lift. | Per well. | Duty per pair. | COST. Annual. Interest at 5 p. c. | Repairs, &c. | Total. | Per Acre. Per acre irrigated. | Lifting. | Total. | Remarks. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 92 | 93 | 94 | 95 | 96 | 97 | 98 | 99 | 100 | 101 | 102 | 103 | 104 | 105 | 106 | 107 | 108 | 109 | 110 | 111 | 112 | 113 | 114 | 115 | 116 |
| 369 | 437 | 429 | 162 | 324 | 2,362 | 1·153 | 504 | 430 | Tobacco, .. | 2 | 5 days, | 20,000 | ·118 | ·60 | 4·4 | 2·2 | 2·2 | .. | 0·4 | 13·5 | 13·9 | | | | |
| 374 | 482 | 781 | 91 | 182 | 2,921 | ·780 | 375·5 | 670 | „ .. | 1 | .. | 11,856 | ·246 | 1·0 | 14·6 | 7·34 | 2·45 | .. | 15·3 | 15 | 30·3 | | | | Only 2 lifts working on account of recent rain fall. |
| 381 | 345 | 326 | 164 | 328 | 1,871 | ·894 | 309 | 300 | Garden, .. | 1 | .. | 7,920 | ·236 | 1·5 | 11·0 | 5·5 | 5·5 | .. | 1·6 | 10·0 | 11·6 | | | | |
| 386 | 465 | 566 | 196 | 392 | 3,022 | ·970 | 451 | 230 | .. | 4 | 20 days, | 15,000 | ·20 | 1·5 | 5·8 | 2·9 | 2·9 | .. | 1·6 | 10 | 11·6 | | | | |
| 389 | 650 | 823 | 100 | 200 | 4,354 | ·775 | 503 | 500 | .. | 4 | 30 days, | 24,160 | ·18 | 1·2 | 7·6 | 3·8 | 1·9 | .. | 12·8 | 10 | 31·8 | | | | |
| 394 | 463 | 566 | 240 | 480 | 3,693 | ·972 | 450 | 750 | Gujai, .. | 2 | 45 days, | 15,000 | ·246 | ·75 | 5·8 | 2·9 | 2·9 | .. | 10·1 | 11·0 | 21·1 | | | | |
| 400 | 280 | 309 | 186 | 373 | 1,738 | ·853 | 239 | 360 | Tobacco, .. | 1 | .. | 12,000 | ·145 | 1·0 | 7·2 | 3·63 | 3·63 | .. | 10·1 | 10·0 | 20·1 | | | | |
| 406 | 632 | 530 | 147 | 295 | 3,100 | ·904 | 571 | 810 | Wheat, .. | 3 | 75 days, | 6,918 | ·45 | ·75 | 12·5 | 6·3 | 6·3 | .. | 0·5 | 11·0 | 11·5 | | | | Field was high and sandy. |
| 410 | .. | .. | .. | .. | .. | .. | .. | 1,420 | „ .. | 3 | 75 days, | 11,423 | .. | ·75 | 7·6 | 3·8 | .. | .. | .. | .. | .. | | | | |
| 412 | 673 | 773 | 197 | 395 | 4,435 | 1·327 | 893 | 235 | „ .. | 3 | 75 days, | 39,374 | ·238 | ·90 | 4·6 | 2·3 | ·70 | .. | 16·5 | 39·0 | 55·5 | | | | |
| 414 | 673 | 857 | 228 | 456 | 5,110 | 1·418 | 954 | .. | „ .. | .. | .. | .. | .. | .. | 4·6 | 2·3 | .. | .. | .. | .. | .. | | | | |

TABLE A.—*Observation and Experiment*—(Continued).

STATISTICAL.

| Serial Number. | Province. | District. | Locality: Pergunna. | Locality: Village. | Year. | Area in Acres: Actual area in acres. | Area in Acres: Percentage unculti-vated: Waste. | Area in Acres: Percentage unculti-vated: Culturable. | Cultivated Area: Percentage of actual area cultivated. | Cultivated Area: Double cropped area in acres. | Cultivated Area: Total area actually cul-tivated in the year. | Percentage of Total Cultivated Area: Wet. | Percentage of Total Cultivated Area: Dry. | Kharif: Wet: Wells. | Kharif: Wet: Canals. | Kharif: Wet: Other sources. | Kharif: Dry. | Kharif: Total. | Rabi: Wet: Wells. | Rabi: Wet: Canals. | Rabi: Wet: Other sources. | Rabi: Dry. | Rabi: Total. | Irrigation Wells: Lime masonry. | Irrigation Wells: Dry bricks. | Irrigation Wells: Kucha. | Irrigation Wells: Total. | Lifts: Leather bucket. | Lifts: Earthen pots. | Lifts: Total. | Usual labor for lifting buckets. | Average area per lift in acres: Kharif. | Average area per lift in acres: Rabi. | Average area per lift in acres: Total. | Remarks. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 |
| 425 | | | Serawah, .. | Karkauda, .. | 1879-80 | 2676·47 | 8·2 | 11·9 | 79·9 | 412·6 | 2549·35 | 39·6 | 60·4 | 12·8 | .. | ·007 | 30·6 | 43·4 | 26·6 | .. | 0·2 | 29·8 | 56·6 | 3 *p*-3<br>2 *p*-16<br>1 *p*-31 | .. | ..<br>2 *p*-1 | 62 | 85 | .. | 85 | Bullock, | 3·85 | 8·00 | 11·85 | 2 pairs of cattle per lift generally used. |
| 430 | | | „ .. | Khukuri, .. | 80-81 | 720·72 | 5·0 | 5·6 | 89·4 | 60·22 | 764·42 | 15·8 | 84·2 | 7·3 | .. | 3 | 45·5 | 53·1 | 8·2 | .. | .. | 38·7 | 46·9 | „<br>4 *p*-3 | „ | „ | .. | 88 | .. | 88 | „ | 6·42 | 8·00 | 14·42 | „ „ |
| 434 | | MEERUT. | Meerut, .. | Meerut, .. | 79-80 | 4890·8 | 21·3 | 16·3 | 62·4 | 1436·6 | 4488·25 | 68·1 | 31·9 | 18·08 | 1·4 | 0·02 | 23·1 | 42·6 | 43·9 | 4·7 | .. | 8·8 | 57·4 | 3 *p*-1<br>2 *p*-1<br>1 *p*-2<br>1 *p*-265 | .. | .. | 7<br>142 | 19<br>415 | .. | 19<br>242 | „ | 3·00 | 3·2 | 6·2 | „ „ |
| 436 | | | „ .. | Mahalla Kiraj, | 80-81 | 4890·8 | 22·5 | 12·9 | 64·6 | 1408·25 | 4567·0 | 61·0 | 39·0 | 19·8 | 1·6 | .. | 23·8 | 45·2 | 36·7 | 2·9 | .. | 15·2 | 54·8 | 2 *p*-8<br>1 *p*-265<br>2 *p*-8 | .. | 142 | 415 | 100<br>90 | 142<br>142 | 242<br>232 | „ | 3·37<br>3·94 | 8·14<br>7·22 | 11·51<br>11·16 | |
| 444 | W. P. | | Khátauli, .. | Khátauli, .. | 79-80 | 2479·0 | 15·7 | 9·9 | 74·4 | 282·53 | 1228·62 | 53·9 | 46·1 | 3·4 | 15·6 | 0·7 | 32·6 | 52·3 | 54·5 | 28·7 | 0·05 | 13·5 | 47·7 | 1 *p*-7 | .. | 90 | 97 | 7 | 90 | 97 | „ | 10·99 | 1·2 | 2·19 | |
| 449 | | | „ .. | „ .. | 80-81 | 2479·0 | 16·6 | 10·1 | 73·3 | 350·3 | 2167·95 | 39·8 | 60·2 | 3·0 | 16·5 | 0·7 | 23·5 | 43·7 | 3·1 | 16·2 | 0·3 | 36·7 | 56·3 | 1 *p*-7 | .. | 90 | 97 | 7 | 90 | 97 | „ | 0·70 | 0·8 | 1·5 | |
| 453 | N. | | Manglaur, .. | Roorkee, .. | 79-80 | 1970 | 50·4 | 3·4 | 46·2 | 235 | 1145 | 6·6 | 93·4 | 2·5 | 0·7 | .. | 49·6 | 52·8 | 2·4 | 1·0 | .. | 43·8 | 47·2 | 87 | 10 | 25 | 122 | 9 | 9 | 18 | „ | 1·61 | 1·55 | 3·16 | |
| | | | „ .. | „ .. | 80-81 | 1970 | 48·8 | 3·8 | 47·4 | 288 | 1221 | 5·5 | 94·5 | 1·6 | 0·8 | .. | 40·5 | 42·9 | 2·6 | 0·5 | .. | 54·0 | 57 1 | 87 | 10 | 25 | 122 | 9 | 9 | 18 | „ | 1·11 | 1·72 | 2·83 | |
| | | | Bhurpur, .. | Nurpur, .. | 79-80 | 2445·84 | 8·4 | 16·1 | 75·5 | .. | 1848·2 | 6·3 | 93·7 | 6·0 | .. | .. | 54·5 | 60·5 | ·3 | .. | .. | 39·2 | 39·5 | .. | .. | 55 | 55 | 12 | 43 | 55 | „ | 2·04 | 0·10 | 2 14 | |
| | | | „ .. | „ .. | 80-81 | 2445·84 | 9·4 | 15·6 | 75·0 | 119·7 | 1954·2 | 5·4 | 94·6 | 5·0 | .. | .. | 47·4 | 52·4 | ·4 | .. | .. | 47·2 | 47·6 | .. | .. | 51 | 51 | 11 | 40 | 51 | „ | 1·92 | 0·16 | 2·08 | |
| 465 | | BIJNOR. | Chándpur, .. | Pheona, .. | 79-80 | 1863·0 | 6·8 | 6·6 | 86·6 | 278·97 | 1891·75 | 10·0 | 90·0 | 9·8 | .. | .. | 38·8 | 48·6 | 0·01 | .. | 0·2 | 51·2 | 51·4 | 2 | .. | 41 | 43 | 39 | .. | 39 | „ | 4·42 | .. | 4·42 | Nearly all sugarcane irrigation. |
| | | | „ .. | „ .. | 80-81 | 1863·0 | 6·7 | 7·8 | 85·5 | 191·8 | 1784 36 | 4·6 | 95·4 | 4·5 | .. | .. | 56·6 | 61·1 | 0·10 | .. | .. | 38·8 | 38·9 | 2 | .. | 9 | 11 | 11 | .. | 11 | „ | 9·2 | 0·21 | 9·41 | |

TABLE A.—*Observation and Experiment*—(Continued).

| DESCRIPTIVE. | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Serial Number. | Date. Day. | Date. Month. | Date. Year. | Number of Well. | Class. | Cost. Construction. | Cost. Fittings. | Cost. Total. | Cost. Renewal. | Cost. Lifts. | Cost. Yearly repairs. | Cost. Total. | Supply. | Quality. | Substratum. | Cultivators on well. Number. | Cultivators on well. Caste. | Labor and cost per day in annas. Men, home. | Do. hired. | Rate, per day. | Cattle. | Cost for men. | Do. for cattle. | Total cost, per day. |
| 37 | 38 | 39 | 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 | 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 | 61 |
| 419 | 26 | 2 | 82 | 615 | Masonry, 5 years, | 300/- | 6/- | 306/- | .. | 8/- | 1/- | 17/- | Spring, .. | Sweet, .. | Clay, | 1<br>3 | Mali,<br>Chamars, | 4 | 2 | 1·5 | 8 | 6 | 12 | 1/2/- |
| 425 | 27 | 2 | 82 | 1,973 | „ old, .. | 300/- | 6/- | 306/- | .. | 8/- | 1/- | 17/- | „ .. | „ .. | „ 27', .. | 9 | Thaggas, .. | 4 | 2 | 1·3 | 8 | 6·3 | 12 | 1/2/3 |
| 430 | 27 | 2 | 82 | 35 | „ 40 years' old, | 400/- | 10/- | 410/- | .. | 8/- | 1/- | 25/- | „ .. | „ .. | „ 45', | 12<br>1 | „<br>Brahmin, | 7 | 3 | 1·5 | 12 | 10·5 | 18 | 1/12/6 |
| 434 | 28 | 2 | 82 | 71 | „ old, .. | 300/- | 6/- | 306/- | .. | 8/- | 1/- | 17/- | „ .. | „ .. | „ 40', .. | 1 | Pathan, .. | .. | 3 | 2·0 | 4 | 6 | 6 | -/13/3 |
| | 1 | 3 | 82 | | | | | | | | | | | | „ .. | .. | „ .. | .. | 1 | 1·25 | .. | 1·25 | .. | .. |
| | 1 | 3 | 82 | | | | | | | | | | | | „ .. | .. | „ .. | 2 | 1 | 2·0 | 4 | 3 | 6 | -/9/- |
| 439 | 28 | 2 | 82 | 72/66 | „ .. | 150/- | 3/- | 153/- | .. | 9/- | 1/- | 10/- | „ .. | „ .. | „ | 1<br>1<br>1<br>1 | Pathan,<br>Mali,<br>Kurmi,<br>Berai, | 2 | 1 | 2·0 | 4 | 3 | 6 | -/9/- |
| 444 | 3 | 3 | 82 | 1,374 | , .. | 100/- | 4/- | 104/- | .. | 8/- | 1/- | 9/- | „ .. | „ .. | „ 26', | 10<br>1 | Thaggas,<br>Mali, | 5 | .. | .. | 8 | 4 | 12 | 1/- |
| 447 | 3 | 3 | 82 | 335 | „ .. | 100/- | 4/- | 104/- | .. | 8/- | 1/- | 9/- | „ .. | „ .. | „ .. | x | Thaggas, .. | 4 | .. | .. | 4 | 3 | 6 | -/9/- |
| 449 | 6 | 3 | 82 | 681 | Kucha lined, .. | 14/- | 2/5 | 16/5 | 2/- | 6/- | 1/- | 7/- | „ .. | „ .. | „ 30', .. | 1 | Mali, .. | 1 | 2 | 2·0 | 2 | 4 | 3 | -/7/- |
| 451 | 6 | 3 | 82 | 686 | Masonry, .. | 100/- | 3/- | 103/- | .. | 6/- | 1/- | 7/- | „ .. | „ .. | „ .. | 1 | „ .. | 1 | 2 | 2·0 | 4 | 4 | 6 | -/10/- |
| 453 | 17 | 3 | 82 | 828 | Kucha lined, .. | 3/- | 2/- | 5/- | 17/- | 4/- | 1/- | 6/- | Percolation, | „ .. | Sand, .. | 1 | Musalman, .. | 3 | .. | .. | 2 | 2 | 3 | -/5/- |
| 455 | .. | .. | .. | 803 | „ „ .. | 3/- | 2/- | 5/- | 1/- | 4/- | 1/- | 6/- | „ .. | „ .. | „ .. | .. | „ .. | 3 | .. | .. | 2 | 2 | 3 | -/5/- |
| 457 | .. | .. | .. | 764 | „ „ .. | 3/- | 2/- | 5/- | 1/- | 4/- | 1/- | 6/- | „ .. | „ .. | „ .. | 2 | Jats, .. | 3 | .. | .. | 2 | 2 | 3 | -/5/- |
| 459 | .. | .. | .. | 760 | „ „ .. | 3/- | 2/- | 5/- | 1/- | 4/- | 1/- | 6/- | „ .. | „ .. | „ .. | 2 | „ .. | 3 | .. | .. | 2 | 2 | 3 | -/5/- |
| 460 | .. | .. | .. | 2,515 | „ „ .. | 5/- | 1/- | 6/- | 1/- | 1/- | 1/- | 3/- | „ .. | „ .. | „ .. | 1 | Kachi, .. | 2 | .. | .. | .. | 1 | .. | -/1/- |
| 463 | .. | .. | .. | 2.523 | „ „ .. | 5/- | 1/- | 6/- | 1/- | 1/- | 1/- | 3/- | „ .. | „ .. | „ .. | 1 | Mali, .. | 2 | .. | .. | .. | 1 | .. | -/1/- |
| 465 | 18 | 3 | 82 | 138A | „ „ .. | 10/- | 1/- | 11/- | 1/- | 4/- | 1/- | 6/- | Spring, .. | „ .. | Clay 13', .. | x | Chamar, .. | 6 | .. | .. | 8 | 5 | 12 | 1/1/- |
| 467 | .. | .. | .. | 138B | „ „ .. | 10/- | 1/- | 11/- | 1/- | 1/- | 1/- | 6/- | „ .. | „ .. | „ .. | .. | „ .. | 4 | 2 | 1·0 | 8 | 5 | 12 | 1/1/- |
| 469 | .. | .. | .. | 180 | „ „ .. | 10/- | 1/- | 11/- | 1/- | 4/- | 1/- | 6/- | „ .. | „ .. | „ .. | .. | „ .. | 6 | .. | .. | 8 | 5 | 12 | 1/1/- |
| 471 | 19 | 3 | 82 | 5,793 | „ „ .. | 5/- | 2/- | 7/- | 1/- | 3/- | 1/- | 5/- | „ .. | „ .. | „ 15', .. | 6 | Musalmen, .. | 3 | .. | .. | 4 | 2 | 6 | -/8/- |
| 472 | .. | .. | .. | 5,744 | „ „ .. | 5/- | 2/- | 7/- | 1/- | 3/- | 1/- | 5/- | „ .. | „ .. | „ .. | 1 | „ .. | 3 | .. | .. | 4 | 2 | 6 | -/8/- |

TABLE A.—*Observation and Experiment*—(Continued).

| Serial Number. | EXPERIMENTAL. COMMAND. *Run.* Class. | Pairs of cattle to each lift. | *Lift.* Number. | Content in cubic feet. | *Depth to Wells.* Morning. | Evening. | Mean. | Soil. | *Kharif* 1881-82. Crop. | Waterings required. | Area. | Total area reduced to one watering. | No. of days to area. | *Rabi* 1881-82. Crop. | Waterings required. | Area. | Total area reduced to one watering. | No. of days to area | AREA IRRIGATED TO DATE. *Kharif* 1881-82. Crop. | Waterings given. | Area. | Working days to date. | *Duty.* Per lift. | Per pair. | *Rabi* 1881-82. Crop. | Waterings given. | Area. | Working days to date. | *Duty.* Per lift. | Per pair. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 62 | 63 | 64 | 65 | 66 | 67 | 68 | 69 | 70 | 71 | 72 | 73 | 74 | 75 | 76 | 77 | 78 | 79 | 80 | 81 | 82 | 83 | 84 | 85 | 86 | 87 | 88 | 89 | 90 | 91 |
| 419 | Kili, 2 pur, .. | 2 | 2 | .. | 20 | .. | .. | Dumat, .. | Cotton, .. | .. | .. | .. | .. | Barley, .. | 3 | 0·47 | 61·5 | 123 | Cotton, .. | .. | .. | .. | .. | .. | Barley, .. | 2 | 0·47 | 1 | ·470 | ·235 |
| | | | | | | | | | | | | | | Wheat, .. | 4 | 11·3 | | | | | | | | | Wheat, .. | 2 | 11·3 | 47 | ·240 | ·120 |
| | | | | | | | | | | | | | | Oats, .. | 4 | 0·23 | | | | | | | | | Oats, .. | 2 | 0·23 | ·5 | ·460 | ·230 |
| | | | | | | | | | | | | | | Carrots, .. | 6 | 0·34 | | | | | | | | | Carrots, .. | 6 | 0·34 | 3 0 | ·340 | ·340 |
| | | | | | | | | | | | | | | Garden, .. | 6 | 2·00 | | | | | | | | | Garden, .. | 5·3 | 2·00 | 12·0 | ·442 | ·221 |
| 425 | „ „ .. | 2 | 2 | 5·23 | 20·5 | 27·5 | 24 | Sandy, .. Dumat, .. | Sugar, .. Cotton, .. | 8 1 | 7·75 2·0 | 64 | 128 | Barley, Peas, .. | 3 | 7 2 | 61 | 122 | Sugar, .. Cotton, .. | 5 .. | 7·75 2·0 | 80 .. | ·242 .. | ·121 .. | Barley, Peas, | 2·55 | 7·2 | 40 | ·230 | ·115 |
| | | | | | | | | | | | | | | Peas, .. | 3 | 0·875 | | | | | | | | | Peas, .. | 2 | 0·875 | 4 | ·218 | ·109 |
| | | | | | | | | | | | | | | Wheat, .. | 4 | 9·25 | | | | | | | | | Wheat, .. | 2 | 9·25 | 44 | ·210 | ·105 |
| | | | | | | | | | | | | | | Gram, .. | 1 | 0 7 | | | | | | | | | Gram, .. | .. | 0·7 | .. | .. | .. |
| 430 | „ „ .. | 2 | 3 | 5·34 | 22 | 28 | 25 | Sandy, .. Matyar, .. | „ .. | .. | .. | .. | .. | Barley, .. | 3 | 2·62 | 102 | 102 | „ .. | .. | .. | .. | .. | .. | Barley, .. | 3 | 2·62 | 18 | ·146 | ·073 |
| | | | | | | | | | | | | | | Guchana, .. | 4 | 9·00 | | | | | | | | | Guchana, .. | 1 | 9·00 | 18 | ·167 | ·083 |
| | | | | | | | | | | | | | | Wheat, .. | 4 | 14·43 | | | | | | | | | Wheat, .. | 1·5 | 14·43 | 32 | ·218 | ·109 |
| 434 | „ „ .. | 2 | 1 | 5·0 | 20·5 | 28 | 24·25 | Matyar, .. | „ .. | .. | .. | .. | .. | „ .. | 3 | 7·22 | 21·66 | 37 | „ .. | .. | .. | .. | .. | .. | Wheat, .. | 2 | 7·22 | 11 | ·656 | ·328 |
| | | | | | 20·5 | 33·5 | 27 | | | | | | | | | | | | | | | | | | | | | | | |
| | „ „ .. | 2 | 1 | 4·05 | .. | .. | 27 | „ .. | „ .. | .. | .. | .. | .. | Potatoes, .. | 10 | 2·7 | 27·00 | 15 | „ .. | .. | .. | .. | .. | .. | Potatoes, .. | 4 | 2·70 | 8 | ·675 | ·337 |
| | | | | | | | | | | | | | | Garden, .. | 10 | 1·28 | 12·80 | 22 | | | | | | | Garden, .. | 2 | 1·28 | 2 | ·640 | ·320 |
| 439 | „ „ .. | 2 | 1 | 6·64 | 18 | 19·4 | 13·7 | „ .. | „ .. | .. | .. | .. | .. | Barley, .. | 2 | 3·91 | 7·82 | .. | | | | | | | Barley, .. | 1 | 3·91 | 6* | ·651 | ·325 |
| | | | | | | | | | | | | | | Wheat, .. | 3 | 5·20 | 15·60 | 75 | „ .. | .. | .. | .. | .. | .. | Wheat, .. | 1 | 5·20 | 15* | ·346 | ·173 |
| | | | | | | | | | | | | | | Potatoes, .. | 10 | 1·31 | 13·1 | 39·3 | | | | | | | Potatoes, .. | 1 | 1·31 | 2† | ·650 | ·325 |
| 444 | „ „ .. | 4 | 1 | 4·5 | 12 | 18·8 | 15·4 | Dumat, .. | Sugar, '82-83 | 5 | 12·4 | 62 | 130 | „ .. | .. | .. | .. | .. | Sugar, '82-83 | 0·22 | 12·4 | 8 | ·342 | ·083 | „ .. | .. | .. | .. | .. | .. |
| 447 | „ „ .. | 2 | 1 | .. | 12 | .. | .. | „ .. | „ „ | 5 | 3·5 | 16·5 | 49·5 | Wheat, .. | 4 | 3·53 | 14·12 | 42 | „ „ | .. | 3·5 | .. | .. | .. | Wheat, .. | 4 | 3·53 | 42 | ·336 | ·718 |
| 449 | Lagor, .. | 1 | 1 | 2·36 | 13 | 20 | 16·5 | „ .. | „ .. | .. | .. | .. | .. | Garden, .. | 10 | 2·4 | 24·0 | 69 | „ „ | .. | .. | .. | .. | .. | Garden, | 5 | 2·4 | 30 | ·400 | ·400 |
| 451 | „ .. | 2 | 1 | 3·4875 | 11 | 26 | 18·5 | „ .. | „ .. | .. | .. | .. | .. | „ .. | 10 | 3·4 | 3·4 | 68 | „ „ | .. | .. | .. | .. | .. | „ .. | 4 | 3·4 | 20 | ·680 | ·340 |
| 453 | Kili, .. | 1 | 1 | .. | 17 | .. | .. | Matyar, .. | „ .. | 3 | 1·9 | 5·7 | 27 | „ .. | .. | .. | .. | .. | „ .. | 3 | 1·9 | 27 | ·211 | ·211 | „ .. | .. | .. | .. | .. | .. |
| 455 | „ .. | 1 | 1 | .. | 16 | .. | .. | „ .. | „ .. | 3 | 1·28 | 3·84 | 24 | „ .. | .. | .. | .. | .. | „ .. | 3 | 1·28 | 24 | ·160 | ·160 | „ .. | .. | .. | .. | .. | .. |
| 457 | „ .. | 1 | 1 | .. | 15 | .. | .. | „ .. | „ .. | 3 | 1·84 | 4·02 | 27 | „ .. | .. | .. | .. | .. | „ .. | 2 | 0·6 | 8 | ·150 | ·150 | „ .. | .. | .. | .. | .. | .. |
| 459 | „ .. | 1 | 1 | .. | 15 | .. | .. | „ .. | „ .. | 3 | 1·25 | 3·75 | 18 | „ .. | .. | .. | .. | .. | „ .. | 3 | 1·25 | 18 | ·200 | ·210 | „ .. | .. | .. | .. | .. | .. |
| 460 | Dhenkli, .. .. | 1 | 1 | 0·253 | 19 | 21 | 20 | „ .. | „ .. | .. | .. | .. | .. | „ .. | 10 | 1·25 | 12·5 | 87·5 | „ .. | .. | .. | .. | .. | .. | „ .. | x | 1·25 | 6 | ·210 | .. |
| 463 | „ .. .. | 1 | 1 | 0 20 | 19 | 21 | 20 | „ .. | „ .. | .. | .. | .. | .. | „ .. | 10 | 0·25 | 2·5 | 31 | „ .. | .. | .. | .. | .. | .. | „ .. | x | 0·25 | 3·0 | ·081 | .. |
| 465 | Kili, .. 4 | 1 | 1 | 2·76 | 15 | 18 | 16·5 | Dumat, .. | „ '82-83 | 3 | 8·7 | 26·0 | 29 | „ .. | .. | .. | .. | .. | „ '82-83 | 1 | 1.21 | 2·5 | ·242 | ·060 | „ .. | .. | .. | .. | .. | .. |
| 467 | „ .. 4 | 1 | 1 | 3·48 | 17 | 20 | 18·5 | „ .. | „ „ | 3 | | | | | | | | | | | | | | | | | | | | |
| 469 | „ .. 4 | 1 | 1 | 3·7125 | 15 | 17 | 16 | „ .. | „ „ | 3 | 4·25 | 12·75 | 41 | „ .. | .. | .. | .. | .. | „ „ | 1 | 2·18 | 6·5 | ·335 | ·084 | „ .. | .. | .. | .. | .. | .. |
| 471 | „ .. 2 | 1 | 1 | 2 82 | 17 | 19 | 18 | „ .. | „ .. | .. | .. | .. | .. | Wheat, .. | 1 | 12·0 | 12·0 | 44 | „ .. | .. | .. | .. | .. | .. | Wheat, .. | 1 | 12·0 | 44 | ·272 | ·136 |
| 472 | „ .. 2 | 1 | 1 | 3·44 | 17 | 19 | 18 | „ .. | „ .. | .. | .. | .. | .. | „ .. | 1 | 1·7 | 1·7 | 5 | „ .. | .. | .. | .. | .. | .. | „ .. | 1 | 1·7 | 5 | ·340 | ·170 |

* Incorrectly stated, area seems low, accepted correct.

† Field in ridges.

TABLE A.—*Observation and Experiment*—(Continued).

| Serial Number. | EXPERIMENTAL. WORK. Duration of work, minutes. | No. of lifts. | Cubic feet lifted. Per pair of cattle, per hour. | Per lift, per hour. | Total per well. | H. P. Per bullock. | Total per well. | Length of watercourse. | Area Irrigated. Crop. | Watering. | Interval. | Area in square feet. | Depth. On area. | Of damp. | Days to an Acre. Per pair of cattle. | Per lift. | Per well. | Duty per pair. | COST. Annual. Interest at 5 p. c. | Repairs, &c. | Total. | Per Acre. Per acre irrigated. | Lifting. | Total. | Remarks. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 92 | 93 | 94 | 95 | 96 | 97 | 98 | 99 | 100 | 101 | 102 | 103 | 104 | 105 | 106 | 107 | 108 | 109 | 110 | 111 | 112 | 113 | 114 | 115 | 116 |
| 419 | .. | .. | .. | .. | .. | .. | .. | .. | Rabi, .. | x | .. | 22,000 | .. | .. | 8·0 | 4 0 | 2·0 | .. | 15·3 | 17·0 | 32·3 | | | | |
| 425 | 630 | 1,264 | 157 | 315 | 6,610 | 1·111 | 700 | 1,020 | Wheat, .. | 3 | 60 days, | 22,000 | ·30 | ·90 | 8·0 | 4·0 | 2·0 | .. | 15.3 | 17·0 | 32·3 | | | | |
| 430 | 616 | 2,090 | 180 | 361 | 11,160 | 1·300 | 800 | 1,130<br>2,030 | Barley, ..<br>Guchana, .. | 3<br>2 | 60 days,<br>90 days, | 28,532<br>16,268 | ·25<br>·25 | ·90<br>·70 | 6·0 | 3·0 | 1·0 | .. | 20·5 | 25·0 | 45·5 | | | | |
| 434 | 550 | 542 | 150 | 300 | 2,710 | 1·070 | 587 | 370 | Wheat, .. | 2 | 60 days, | 10,880 | ·25 | ·75 | 6·84 | 3·42 | 1·71 | | | | | | | | Only 1 lift working. |
| | 540 | 572 | 159 | 318 | 2,860 | 1·378 | 744 | 550 | „ .. | 2 | 60 days, | 14,600 | ·20 | ·66 | .. | .. | .. | .. | 15·3 | 171 | 32·3 | | | | |
| | 535 | 705 | 170 | 340 | 3,037 | 1·482 | 793 | 640 | Potatoes, .. | 4 | 60 days, | 38,577 | ·08 | ·75 | 2·26 | 1·13 | 0·56 | | | | | | | | Field in ridges. |
| 439 | 593 | 577 | 193 | 386 | 3,831 | ·946 | 563 | 1,020 | Wheat, .. | 2 | 60 days, | 4,907 | ·1 | ·66 | 7·4 | 3·7 | 3·7 | | | | | | | | |
| | 653 | 633 | 193 | 386 | 4,203 | ·947 | 619 | 1,020 | „ .. | 2 | .. | 13,557 | ·31 | ·66 | 6·4 | 3·2 | 3·2 | .. | 7·6 | 10 | 17·0 | | | | |
| 444 | 700 | 1,358 | 130 | 522 | 6,111 | ·630 | 440 | 800 | Sugar, .. | 1 | .. | 20,770 | ·29 | 1·0 | 8·4 | 2·1 | 2·1 | .. | 5·2 | 9·0 | 14·2 | | | | |
| 447 | .. | .. | .. | .. | .. | .. | .. | x | Wheat, .. | 4 | 30 days, | 14,636 | .. | .. | 6·0 | 3·0 | 3·0 | .. | 5·2 | 9·0 | 14·2 | | | | |
| 449 | 495 | 640 | 183 | 183 | 1,510 | ·970 | 480 | 500 | Potatoes, .. | 3 | 20 days, | 15,175 | ·10 | ·80 | 2·87 | 2·57 | 2·87 | .. | 0·8 | 7·0 | 7·8 | | | | Field in ridges. |
| 451 | 540 | 587 | 114 | 228 | 2,047 | ·770 | 415 | 175 | Garden, .. | 3 | 8 days, | 21,134 | ·10 | ·80 | 4·0 | 2·0 | 2·0 | .. | 5·1 | 7·0 | 12·1 | | | | „ „ |
| 453 | .. | .. | .. | .. | .. | .. | .. | .. | Sugar, .. | 3 | .. | 9,200 | .. | .. | 5·0 | 5·0 | 5·00 | .. | 0·3 | 6 0 | 6·3 | | | | |
| 455 | .. | .. | .. | .. | .. | .. | .. | .. | „ .. | 3 | .. | 7,000 | .. | .. | 6·2 | 6·2 | 6·2 | .. | 0·3 | 6.0 | 6·3 | | | | |
| 457 | .. | .. | .. | .. | .. | .. | .. | .. | „ .. | 2 | .. | 6,500 | .. | .. | 7·0 | 7·0 | 7·0 | .. | 0·3 | 6·0 | 6·3 | | | | |
| 459 | .. | .. | .. | .. | .. | .. | .. | .. | „ .. | 3 | .. | 9,000 | .. | .. | 5·0 | 5·0 | 5·0 | .. | 0·3 | 6·0 | 6·3 | | | | |
| 460 | 520 | 1,383 | .. | 40 | 350 | Per man<br>·400 | 205 | 100 | Garden, .. | x | .. | 6,453 | ·054 | ·80 | .. | 7·0 | 7·0 | .. | 0·3 | 3·0 | 3·3 | | | | Part ridges. |
| 463 | 220 | 569 | .. | 31 | 114 | Per man<br>·300 | 66 | 60 | „ .. | x | .. | 3,460 | ·033 | ·60 | .. | 12·6 | 12·6 | .. | 0·3 | 3·0 | 3·3 | | | | ½ day's work. |
| 465 | 737 | 1,384 | 78 | 313 | 3,819 | ·362 | 267 | 660 | Sugar, .. | 1 | .. | 17,578 | ·22 | ·75 | 9·6 | 2·4 | 2·4 | .. | 0·5 | 6·0 | 6·5 | | | | Paleo. |
| 467 | 775 | 1,441 | 100 | 400 | 5,015 | ·502 | 389 | 1,380 | „ .. | 1 | .. | 22,208 | ·226 | ·66 | 8·0 | 2·0 | 2·0 | .. | 0·5 | 6·0 | 6·5 | | | | „ |
| 469 | 795 | 1,260 | 88 | 353 | 4,678 | ·382 | 303 | 2,030 | „ .. | 1 | .. | 13,531 | ·34 | ·75 | 12·8 | 3·2 | 3·2 | .. | 0·5 | 6·0 | 6·5 | | | | „ |
| | .. | .. | .. | .. | .. | .. | .. | .. | Wheat, .. | 1 | .. | 11,848 | .. | .. | 7·3 | 3·7 | 3·7 | .. | 0·4 | 5·0 | 5·0 | | | | „ |
| | .. | .. | .. | .. | .. | .. | .. | .. | „ .. | 1 | .. | 14,800 | .. | .. | 6·0 | 3·0 | 3·0 | .. | 0·4 | 5·0 | 5·0 | | | | „ |

TABLE A.—*Observation and Experiment*—(Continued).

| Serial Number. | Province. | District. | Pergunna. | Village. | Year. | Statistical: Area in Acres. Actual area in acres. | Percentage uncultivated. Waste. | Percentage uncultivated. Culturable. | Cultivated Area. Percentage of actual area cultivated. | Double cropped area in acres. | Total area actually cultivated in the year. | Percentage of Total Cultivated Area. Kharif. Wet. Wells. | Canals. | Other sources. | Dry. | Total. | Rabi. Wet. Wells. | Canals. | Other sources. | Dry. | Total. | Irrigation Wells. Lime masonry. | Dry bricks. | Kacha. | Total. | Lifts. Leather bucket. | Earthen pots. | Total. | Usual labor for lifting buckets. | Average area per lift, in acres. Kharif. | Rabi. | Total. | Remarks. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 |
| 480 | N. W. P. | MORADABAD. | Chándpur, .. | Rajubpur, .. | 1879-80 | 1060 | 6·5 | 11·1 | 82·4 | 1·08 | 858 | 4·3 | 95·7 | 3·0 | .. | .. | 51·7 | 54·7 | 1·3 | .. | .. | 44·0 | 45·3 | .. | .. | 33 | 33 | .. | 33 | 33 | Bullock, | 0·77 | 2·24 | 3·01 | |
| 484 | | | „ .. | „ .. | 80-81 | 1060 | 6·4 | 11·2 | 82·4 | 6·0 | 863·65 | 4·6 | 95·4 | 3·8 | .. | .. | 47·6 | 51·4 | 0·8 | .. | .. | 47·8 | 48·6 | .. | .. | 61 | 61 | .. | 61 | 61 | „ | 0·51 | 0·80 | 1·31 | |
| | | | „ .. | Burhanpur, .. | 79-80 | 358 | 11·4 | 17·2 | 71·4 | 2·8 | 258·65 | 1·3 | 98·7 | 1·3 | .. | .. | 64·4 | 65·7 | .. | .. | .. | 34·3 | 34·3 | .. | .. | 3 | 3 | .. | 6 | 6 | „ | 0·54 | .. | 0·54 | |
| | | | „ .. | „ .. | 80-81 | 358 | 11·4 | 15·7 | 72·9 | 10·85 | 271·94 | 0·4 | 99·6 | 0·4 | .. | .. | 61·2 | 61·6 | .. | .. | .. | 38·4 | 38·4 | .. | .. | 1 | 1 | .. | 2 | 2 | „ | 0·5 | .. | 0·5 | |
| 488 | | | RAMPUR, .. | Lohab, .. | .. | .. | .. | .. | .. | .. | .. | .. | .... | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | Native State. |
| 490 | | | Kiror, .. | Nekpur, .. | 79-80 | 854·0 | 30·5 | 16·2 | 53·3 | 103·5 | 558·65 | 20·6 | 79·4 | 5·0 | .. | 0·5 | 51·0 | 56·5 | 7·5 | .. | 7·6 | 28·4 | 43·5 | 8 | 12 | 47 | 67 | 11 | 56 | 67 | „ | 0·42 | 0·62 | 1·04 | Wells examined are in Mukranapur. |
| 492 | | | „ .. | „ .. | 80-81 | 854·0 | 29·0 | 15·6 | 55·4 | 23·10 | 685·4 | 9·5 | 90·5 | 4·0 | .. | 0·2 | 50·0 | 54·2 | 5·3 | .. | .. | 40·5 | 45·8 | 8 | 10 | 68 | 96 | 11 | 85 | 96 | „ | 0·30 | 0·40 | 0·70 | |
| 497 | | | Nawábgang, | Nawábgang, .. | 79-80 | 888·35 | 9·4 | 11·6 | 79·0 | 102·7 | 804·75 | 21·2 | 78·8 | 5·13 | .. | 0·7 | 46·8 | 52·0 | 7·9 | 0·3 | 7·8 | 32·0 | 48·0 | .. | .. | 35 | 35 | .. | 35 | 35 | „ | 1·20 | 1·80 | 3·00 | |
| 499 | | | „ | „ .. | 80-81 | 888·35 | 8·8 | 10·5 | 80·7 | 121·7 | 838·2 | 5·5 | 94·5 | 4·9 | .. | 2·0 | 56·7 | 61·8 | 0·3 | 0·1 | .. | 37·8 | 38·2 | .. | .. | 24 | 24 | .. | 24 | 24 | „ | 1·70 | 0·12 | 1·82 | |
| 501 | | | Púranpur, .. | Púranpur, .. | 79-80 | 1508·0 | 9·5 | 16·0 | 74·5 | 168·15 | 1290·9 | 3·1 | 96·9 | 2·9 | .. | .. | 42·9 | 45·8 | 0·2 | .. | .. | 54·0 | 54·2 | .. | .. | 38 | 38 | .. | 70 | 70 | „ | 0·52 | ·05 | 0·57 | Nearly all sugarcane. |
| 505 | | | „ .. | „ .. | 80-81 | 1508·0 | 9·3 | 15·2 | 75·5 | 36·7 | 1175·2 | 2·8 | 97·2 | 2·7 | .. | .. | 58·3 | 61·0 | 0·1 | .. | .. | 38·9 | 39·0 | .. | .. | 44 | 44 | .. | 70 | 70 | „ | 0·50 | ·01 | 0 51 | „ „ „ |
| 506 | | | Paváyan, .. | Dhurmangatpur, | 79-80 | 267·2 | 8·8 | 23·1 | 68·1 | 31·62 | 213·37 | 34·6 | 65·4 | 4·9 | .. | .. | 30·6 | 35·5 | 21·0 | .. | 8·7 | 34·8 | 64·5 | 1 | .. | 8 | 9 | 9 | .. | 9 | Men, | 1·13 | 5·0 | 6·13 | |
| 507 | | | „ .. | „ .. | 80-81 | 267·2 | 8·9 | 21·5 | 69·6 | 29·75 | 215·60 | 8·9 | 91·1 | 8·2 | .. | 0·3 | 48·3 | 56·8 | .. | .. | 0·4 | 42·8 | 43·2 | 1 | .. | 2 | 3 | 3 | .. | 3 | „ | 5·93 | .. | 5·93 | W. S. has fallen 5' to 6' (1882-83). |
| 514 | | | Sháhjahánpur, | Sháhjahánpur, | 79-80 | 3088·0 | 48·4 | 11·1 | 40·5 | .. | 1249·8 | 62·9 | 37·1 | 31·7 | .. | 0·6 | 18·5 | 50·8 | 13·4 | .. | 17·2 | 18·6 | 49·2 | 1 *p*-27 | .. | 1 *p*-50 Dhenkli 10 Ráti 77 | 164 | 77 | 87 | 164 | Men and Bullock, | 3·06 | 1·01 | 4·07 | W. S. has fallen 3' (1882-83). |
| 516 | | | „ .. | „ .. | 80-81 | 3100·5 | 48·3 | 10·2 | 41·5 | 378·7 | 1667·0 | 66·1 | 33·9 | 23·5 | .. | 3·5 | 20·0 | 47·0 | 13·1 | .. | 26·0 | 13·9 | 53·0 | 1 *p*-27 | .. | 1 *p*-50 Dhenkli 15 Ráti 196 | 288 | 77 | 211 | 288 | „ | 1·40 | 0·8 | 2·2 | |
| 520 | | | Jalálabad, .. | Jalálabad, .. | 79-80 | 716·0 | 25·3 | 17 7 | 57·0 | 46·0 | 453·3 | 28·5 | 71·5 | 1·8 | .. | .. | 38·7 | 40·5 | 12·4 | .. | 14·3 | 32·8 | 59·5 | .. | .. | Dhenkli 65 Ráti 12 | 77 | .. | 77 | 77 | „ | 0·11 | 0·74 | 0·85 | W. S. rises 6' with Ramganga floods. |
| 522 | | | „ .. | „ .. | 80-81 | 716·0 | 25·7 | 15·9 | 58·0 | 56 75 | 474·45 | 41·1 | 58·9 | 3·4 | .. | .. | 38·4 | 41·8 | 24·5 | .. | 13·2 | 20·5 | 58·2 | .. | .. | Dhenkli 95 Ráti 14 | 109 | .. | 109 | 109 | „ | 0·15 | 1·06 | 1·21 | |

TABLE A.—*Observation and Experiment*—(Continued).

| DESCRIPTIVE. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Serial Number. | *Date.* | | | Number of Well. | *Class.* | *Cost.* | | | | | | | *Supply.* | *Quality.* | *Substratum.* | *Cultivators on well.* | | *Labor and cost per day in annas.* | | | | | | | | | | | | | | |
| | Day. | Month. | Year. | | | Construction. | Fittings. | Total. | Renewal. | Lifts. | Yearly repairs. | Total. | | | | Number. | Caste. | Men, home. | Do. hired. | Rate, per day. | Cattle. | Cost for men. | Do. for cattle. | Total cost, per day. | | | | | | | | |
| 37 | 38 | 39 | 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 | 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 | 61 | | | | | | | | |
| | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 1 | Mali, .. | 3 | 4 | 2·0 | 8 | 10 | 12 | 1/6/- | | | | | | | | |
| 476 | 20 | 3 | 82 | 4,556 | Kucha lined, .. | 6·5 | 2/- | 8·5 | 2/- | 5/- | 1/- | 8/- | Spring, .. | Sweet, .. | Clay, 20', .. | 1 | Musalman, .. | 1 | 2 | 1·5 | 2 | 3 | 3 | -/6/- | | | | | | | | |
| 478 | 20 | 3 | 82 | 4,398 | „ unlined, | 4/- | 2/- | 6/- | 2/- | 4/- | 1/- | 7/- | „ .. | „ .. | „ 17', .. | 7 | Malis, .. | 3 | .. | .. | 4 | 2 | 6 | -/8/- | | | | | | | | |
| 480 | 21 | 3 | 82 | .. | „ lined, .. | 1·5 | 0·5 | 2/- | 1·5 | 1/- | .. | 2·5 | „ .. | „ .. | Sand, .. | 1 | Jat, .. | 1 | 2 | 1·5 | .. | 3 | .. | -/3/- | | | | | | | | |
| 484 | 24 | 3 | 82 | 104 | „ „ .. | 2·5 | 1/- | 3·5 | 2/- | 1/- | .. | 4/- | „ .. | „ .. | „ .. | 3 | Chamars, .. | 3 | .. | .. | .. | 2 | .. | -/2/- | | | | | | | | |
| 488 | 27 | 3 | 82 | .. | „ „ .. | 5/- | 1/- | 6/- | 2/- | 1/- | .. | 3/- | „ .. | „ .. | „ .. | 2 | Kachis, .. | 2 | .. | .. | .. | 1 | .. | -/1/- | | | | | | | | |
| 490 | 30 | 3 | 82 | 43 | Masonry, .. | 250/- | 3/- | 759/- | .. | 10/- | 1/- | 33/- | „ .. | „ .. | Clay, | 12 | „ .. | 2 | 1 | 2·0 | 2 | 3 | 3 | -/13/- | | | | | | | | |
| | | | | 46 | „ .. | 250/- | 3/- | | | | | | | | | 12 | „ .. | 1 | 2 | 2·0 | 2 | 4 | 3 | .. | | | | | | | | |
| | | | | .. | „ .. | 250/- | 3/- | | | | | | | | | .. | „ .. | 3 | .. | .. | 2 | 2 | 3 | -/5/- | | | | | | | | |
| 494 | 30 | 3 | 82 | 39 | „ .. | 250/- | 3/- | 253/- | .. | 8/- | 1/- | 9/- | „ .. | „ .. | „ .. | 1 | „ .. | 1 | 2 | 2·0 | 2 | 4 | 3 | -/7/- | | | | | | | | |
| 497 | 31 | 3 | 82 | .. | Kucha lined, .. | 2/- | 1/- | 3/- | .. | 1/- | 1/- | 2/- | „ .. | „ .. | „ .. | 1 | „ .. | 2 | .. | .. | .. | 1 | .. | -/1/- | | | | | | | | |
| 501 | 3 | 4 | 82 | 201 | „ unlined, .. | ·5 | 1/- | 1·5 | 0·5 | 1/- | .. | 1·5 | Percolation, | „ .. | Sand, | 1 | Pathan, | .. | 4 | 2 | .. | 8 | .. | -/8/- | | | | | | | | |
| | | | | | | | | | | | | | | | | 1 | Carpenter, | | | | | | | | | | | | | | | |
| 505 | 7 | 4 | 82 | 112 | „ lined, .. | 2/- | 2/- | 4/- | 2/- | 4/- | .. | 6/- | Spring, .. | „ .. | Clay, 20', | 1 | Pasi, | 3 | 5 | 1·25 | .. | 8·25 | .. | -/8/3 | | | | | | | | |
| | | | | | | | | | | | | | | | | 2 | Brahmin, | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | 5 | Chamars, | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | 1 | Barber, | | | | | | | | | | | | | | | |
| 508 | 7 | 4 | 82 | 220 | Masonry, .. | 100/- | 3/- | 103/- | .. | 4/- | 1/- | 5/- | „ .. | „ .. | „ „ | 1 | Carpenter, | 5 | 3 | 1·25 | .. | 7·75 | .. | -/7/9 | | | | | | | | |
| | | | | | | | | | | | | | | | | 2 | Blacksmiths, | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | 1 | Jat, | | | | | | | | | | | | | | | |
| 514 | 8 | 4 | 82 | 606 | „ .. | 180/- | 2/- | 182/- | .. | 10/- | 1/- | 11/- | „ .. | „ .. | „ 42', .. | 1 | Kachi, .. | 1 | 1 | 1·5 | 2 | 1·5 | 3 | -/5/9 | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | 1 | 1·25 | .. | 1·25 | | | | | | | | | | |
| 517 | 9 | 4 | 82 | 166 | „ wood below, | 150/- | 2/- | 152/- | .. | 10/- | 2/- | 12/- | „ .. | „ .. | „ 24', | 2 | Pathans, | .. | 3 | 1·5 | 2 | 4·5 | 3 | -/7/6 | | | | | | | | |
| | | | | | | | | | | | | | | | | 1 | Kachi, | | | | | | | | | | | | | | | |
| 520 | 10 | 4 | 82 | .. | Kucha lined, .. | 2/- | 0·5 | 2·5 | 0·5 | 1/- | 0·5 | 2/- | Percolation, | „ .. | Sand, .. | 1 | „ .. | 2 | .. | .. | .. | 1 | .. | -/1/- | | | | | | | | |
| 522 | 11 | 4 | 82 | 266/1 | „ unlined, very old, .. | .. | 1/- | 1/- | .. | 1/- | .. | 1/- | Spring, .. | „ .. | Clay, 20', .. | x | Kachis, .. | 2 | .. | .. | .. | 1 | .. | -/1/- | | | | | | | | |

TABLE A.—*Observation and Experiment*—(Continued).

EXPERIMENTAL.

| Serial Number. | Run. Class. | Run. Pairs of cattle to each lift. | Lift. Number. | Lift. Content in cubic feet. | Depth to Wells. Morning. | Depth to Wells. Evening. | Depth to Wells. Mean. | Soil. | COMMAND. *Kharif* 1881-82. Crop. | Waterings required. | Area. | Total area reduced to one watering. | No. of days to area. | *Rabi* 1881-82. Crop. | Waterings required. | Area. | Total area reduced to one watering. | No. of days to area. | AREA IRRIGATED TO DATE. *Kharif* 1881-82. Crop. | Waterings given. | Area. | Working days to date. | Duty. Per lift. | Duty. Per pair. | *Rabi* 1881-82. Crop. | Waterings given. | Area. | Working days to date. | Duty. Per lift. | Duty. Per pair. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 62 | 63 | 64 | 65 | 66 | 67 | 68 | 69 | 70 | 71 | 72 | 73 | 74 | 75 | 76 | 77 | 78 | 79 | 80 | 81 | 82 | 85 | 84 | 85 | 86 | 87 | 88 | 89 | 90 | 91 |
| | Same well, .. | 2 | 2 | .. | .. | .. | .. | Dumat, .. | Sugar, '82-83, | 4 | 1·41 | 5·64 | 15 | Wheat, .. | .. | .. | .. | .. | Sugar, '82-83, | 1 | 1·41 | 3 | ·235 | ·117 | Wheat, .. | .. | .. | .. | .. | .. |
| 476 | Kili, .. | 1 | 1 | 4 5 | 17 | 19 | 18 | „ .. | „ .. | .. | .. | .. | .. | Tobacco, .. | 30 | 1·0 | 30·0 | 87 | „ .. | .. | .. | .. | .. | .. | Tobacco, .. | 6 | 1·00 | 20 | ·300 | ·300 |
| 478 | „ .. | 2 | 1 | 4·0 | 19 | 21 | 20 | „ .. | Indian corn, | *x* | ·9375 | .. | .. | „ .. | 30 | ·9375 | 28·125 | 91 | Indian corn, | *x* | ·9375 | .. | .. | .. | „ .. | 6 | ·9375 | 10 | ·562 | ·281 |
| 480 | Dhenkli, .. | .. | 2 | ·230625 ·30375 | 9·5 9·5 | 10·5 10·5 | 10 10 | Sandy, .. | Sugar, '82-83, | 4 | ·90 | 2·8 | 16 | „ .. | .. | .. | .. | .. | Sugar, '82-83, | 1 | ·7 | 4 | 0·087 | .. | „ .. | .. | .. | .. | .. | .. |
| 484 | „ .. | .. | 2 | ·275625 | 18 6 | 19·0 | 18·8 | „ .. | „ „ | 4 | 1·00 | 4·0 | 44 | „ .. | .. | .. | .. | .. | „ .. | .. | .. | .. | .. | .. | „ .. | .. | .. | .. | .. | .. |
| 488 | Ráti, .. | .. | 2 | ·319 | 21 | 22 | 21·5 | Dumat, .. | „ .. | .. | .. | .. | .. | „ .. | 28 | 0·15 | 4·2 | 76 | „ .. | .. | .. | .. | .. | .. | „ .. | 16 | 0·15 | 32 | ·075 | .. |
| 490 | Kili, .. | 1 | 1 | 5·625 | 36 | 39 | 37·5 | | | | | | | Garden, .. | 28 | 0·07 | 2·0 | | | | | | | | Garden, .. | 16 | 0·07 | 16 | ·075 | .. |
| | „ .. | 1 | 1 | 4·3875 | 35 | 42 | 38·5 | „ .. | „ .. | .. | .. | .. | .. | Tobacco, .. | 20 | 9·4 | 198 | 198 | „ .. | .. | .. | .. | .. | .. | Tobacco, .. | 10 | 9·4 | 140 | ·180 | ·180 |
| | „ .. | 1 | 1 | 5·34 | 35 | 42 | 38·5 | | | | | | | | | | | | | | | | | | | | | | | |
| 494 | „ .. | 1 | 1 | 4·05 | 34 | 42 | 38 | „ .. | „ .. | .. | .. | .. | .. | Wheat, .. | 2 | 0·625 | 31·25 | 219 | „ .. | .. | .. | .. | .. | .. | Wheat, .. | 2 | 0·625 | 10 | ·125 | ·125 |
| | | | | | | | | | | | | | | Tobacco, .. | 10 | 1·5 | | | | | | | | | Tobacco, .. | 12 | 1·50 | 103 | ·166 | ·166 |
| 497 | Ráti, .. | .. | 2 | 0·4 | 9 | 10 | 9·5 | Matyar, .. | „ .. | .. | .. | .. | .. | Garden, .. | 10 | 0·5 | 5·0 | 55 | „ .. | .. | .. | .. | .. | .. | Garden, .. | .. | 0·5 | .. | .. | .. |
| 501 | Dhenkli, .. | .. | 2 | 0·4 | 14 | 17 | 15·5 | Sandy, .. | „ '82-83, | 2 | 2·8 | 5·6 | 30 | „ .. | .. | .. | .. | .. | „ '82-83 | 1 | 2·8 | 1·5 | 0·090 | .. | „ .. | .. | .. | .. | .. | .. |
| 505 | Coolie, .. | Men 6 | 1 | 1·63 | 29 | 31 | 30 | Dumat, .. | „ „ | 2 | 2·44 | 4·88 | 29·28 | Wheat, .. | 1 | 4·5 | 4·5 | 13 | „ „ | 1 | 0·842 | 6 | 0·140 | .. | Wheat, .. | 1 | 4·5 | 13 | ·346 | .. |
| 508 | „ .. | Men 6 | 1 | .. | 22 | 29 | 25·5 | „ .. | „ „ | 2 | 7·56 | 15·12 | 128 | „ .. | 1 | 13·3 | 13·3 | 44·5 | „ .. | 1 | 7·56 | 31·5 | 0·240 | .. | „ .. | 1 | 13·3 | 44·5 | ·300 | .. |
| 514 | Lagor, .. | 1 | 1 | 4·05 | 30 | 34 | 32 | „ .. | „ .. | .. | .. | .. | .. | Tobacco, .. | 20 | 1·72 | 35·5 | 119 | „ .. | .. | .. | .. | .. | .. | Tobacco, .. | 10 | 1·72 | 30 | ·570 | ·570 |
| | | | | | | | | | | | | | | Barley, .. | 2 | 0·56 | | | | | | | | | Barley, .. | 2 | 0·56 | 2 | ·560 | ·560 |
| 517 | „ .. | 1 | 1 | 4·00 | 32 | 35 | 33·5 | „ .. | „ .. | .. | .. | .. | .. | Tobacco, .. | 20 | 2·3 | 46 | 193 | „ .. | .. | .. | .. | .. | .. | Tobacco, .. | 4 | 2·3 | 30 | ·306 | ·306 |
| 520 | Dhenkli, .. | .. | 1 | 0·4 | 12 | 14 | 13 | Matyar, .. | „ .. | .. | .. | .. | .. | Garden, .. | 20 | 0·625 | 12·5 | 137 | „ .. | .. | .. | .. | .. | .. | Garden, .. | *x* | 0·625 | 4 | ·131 | .. |
| 522 | Ráti, .. | .. | 2 | 0·4 | 24 | 25 | 24·5 | „ .. | „ .. | .. | .. | .. | .. | „ .. | 20 | 1·16 | 23·2 | 394 | „ .. | .. | .. | .. | .. | .. | „ .. | *x* | 1·16 | .. | ·087 | .. |

TABLE A.—*Observation and Experiment*—(Continued).

| Serial Number. | EXPERIMENTAL. WORK. Duration of work, minutes. | No. of lifts. | Cubic feet lifted. Per pair of cattle, per hour. | Per lift, per hour. | Total per well. | H. P. Per bullock. | Total per well. | Length of watercourse. | Area Irrigated. Crop. | Watering. | Interval. | Area in square feet. | Depth. On area. | Of damp. | Days to an Acre. Per pair of cattle. | Per lift. | Per well. | Duty per pair. | COST. Annual. Interest at 5 p. c. | Repairs, &c. | Total. | Per Acre. Per acre irrigated. | Lifting. | Total. | Remarks. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 92 | 93 | 94 | 95 | 96 | 97 | 98 | 99 | 100 | 101 | 102 | 103 | 104 | 105 | 106 | 107 | 108 | 109 | 110 | 111 | 112 | 113 | 114 | 115 | 116 |
| | 645 | 744 | 98 | 196 | 2,098 | ·484 | 312 | 800 | Sugar, .. | 1 | .. | 16,089 | ·258 | ·75 | 10·8 | 5·4 | 5·4 | .. | .. | .. | .. | | | | |
| | 588 | 600 | 105 | 210 | 2,064 | ·518 | 304 | .. | „ .. | 1 | .. | | | | 10·8 | 5·4 | 5·4 | | | | | | | | |
| 476 | 247 | 219 | 240 | 240 | 985 | 1·144 | 282 | 270 | Tobacco, .. | 6 | 3 days, | 15,340 | ·064 | ·8 | 2·9 | 2·9 | 2·9 | .. | 0·4 | 8·0 | 8·4 | | | | |
| 478 | 268 | 253 | 112 | 225 | 1,012 | ·622 | 165 | 230 | „ .. | 6 | 4 days, | 13,280 | ·076 | ·70 | 6·5 | 3·25 | 3·25 | .. | 0·3 | 7·0 | 7·3 | | | | |
| | | | | | | Per man | | | | | | | | | | | | | | | | | | | |
| 480 | 621 | 2,863 | .. | 63 | 660 | ·371 | 232 | 180 | Sugar, .. | 1 | .. | 7,800 | ·20 | ·80 | .. | 11·0 | 5·6 | .. | 0·1 | 2·5 | 2·6 | | | | |
| | 628 | 3,062 | .. | 88 | 930 | | | | | | | | | | | | | | | | | | | | |
| | | | | | | Per man | | | | | | | | | | | | | | | | | | | |
| 484 | 570 | 5,004 | .. | 62 | 1,379 | ·565 | 322 | 300 | „ .. | 1 | .. | 4,000 | ·344 | 1·2 | .. | 22·0 | 11·0 | .. | 0·2 | 4·0 | 4·2 | | | | |
| | | | | | | Per man | | | | | | | | | | | | | | | | | | | |
| 488 | 273 | 865 | .. | 60 | 276 | ·615 | 168 | 100 | Tobacco, .. | 16 | 5 days, | 3,546 | ·08 | ·66 | .. | .. | 12·3 | .. | 0·3 | 3·0 | 3·3 | | | | Ráti taken as lift. |
| 490 | 530 | 351 | 224 | 224 | 1,974 | 2·206 | 1,169 | 1,130 | „ .. | 10 | 7 days, | 14,200 | ·13 | ·85 | 3 | 3 | 3 | | | | | | | | |
| | 573 | 464 | 210 | 210 | 2,035 | 2·355 | 1,350 | 500 | „ .. | .. | .. | 14,770 | ·13 | ·80 | 3 | 3 | 2·2 | .. | 38·0 | 33 | 71·0 | | | | |
| | 85 | 163 | 280 | 280 | 870 | 3·064 | 567 | 470 | „ .. | .. | .. | 5,175 | ·17 | ·75 | 8 | 8 | .. | | | | | | | | |
| 494 | 285 | 175 | 148 | 148 | 708 | 1·660 | 473 | 320 | „ .. | 12 | 7 days, | 6,088 | ·115 | ·75 | 7 | 7 | 7 | .. | 12·5 | 9·0 | 21·5 | | | | ½ day's work. |
| | | | | | | Per man | | | | | | | | | | | | | | | | | | | |
| 497 | 180 | 631 | .. | 84 | 252 | ·390 | 70 | 160 | Paleo, .. | .. | .. | 3,000 | ·08 | ·60 | 11 | 11 | 11 | .. | 0·2 | 2·0 | 2·2 | | | | „ „ |
| | | | | | | Per man | | | | | | | | | | | | | | | | | | | |
| 501 | 678 | 1,057 | .. | 19 | 423 | ·100 | 66 | 230 | Sugar, .. | 1 | .. | 8,027 | ·05 | ·70 | .. | 10·8 | 5·4 | .. | 0·1 | 1·5 | 1·6 | | | | Hired labor. |
| | | | | | | Per man | | | | | | | | | | | | | | | | | | | |
| 505 | 697 | 1,211 | .. | 174 | 1,974 | ·487 | 339 | 930 | „ .. | 1 | .. | 7,200 | ·274 | 1·0 | .. | 6 | 6 | .. | 0·2 | 6·0 | 6·2 | | | | |
| 508 | .. | .. | .. | .. | .. | .. | .. | 600 | „ .. | 1 | .. | 5,100 | .. | .. | .. | 8·5 | 8·5 | .. | 5·1 | 5·0 | 10·1 | | | | Measured area. |
| 514 | 568 | 490 | 209 | 209 | 1,984 | 1·864 | 1,059 | 300 | Tobacco, .. | 10 | 6 days, | 12,995 | ·15 | ·90 | 3·35 | 3·35 | 3·35 | .. | 9·1 | 11·0 | 20·1 | | | | |
| 517 | 532 | 438 | 197 | 197 | 1,752 | 1·814 | 965 | 234 | „ .. | 10 | 10 days, | 10,170 | ·173 | ·80 | 4·2 | 4·2 | 4·2 | .. | 7·6 | 12·0 | 19·6 | | | | |
| | | | | | | Per man | | | | | | | | | | | | | | | | | | | |
| 520 | 438 | 900 | .. | 48 | 360 | ·320 | 140 | 120 | Garden, .. | .. | 4 days, | 3,706 | ·09 | ·60 | .. | 11 | 11 | .. | 0·1 | 2·0 | 2·1 | | | | Ridges. |
| | | | | | | Per man | | | | | | | | | | | | | | | | | | | |
| 522 | 261 | 961 | .. | 89 | 385 | 1·02 | 268 | 140 | „ .. | .. | .. | 2,534 | ·11 | ·60 | .. | 17 | 17 | .. | 0·05 | 1·0 | 1·05 | | | | ⅔ day's work. |

TABLE A.—*Observation and Experiment*—(Continued).

| Serial Number. | Province. | District. | Pergunna. | Village. | Year. | STATISTICAL. Area in Acres. Actual area in acres. | Percentage uncultivated. Waste. | Culturable. | Cultivated Area. Percentage of actual area cultivated. | Double cropped area in acres. | Total area actually cultivated in the year. | Percentage of Total Cultivated Area. Wet. | Dry. | Kharif. Wet. Wells. | Canals. | Other sources. | Dry. | Total. | Rabi. Wet. Wells. | Canals. | Other sources. | Dry. | Total. | Irrigation Wells. Lime masonry. | Dry bricks. | Kucha. | Total. | Lifts. Leather bucket. | Earthen pots. | Total. | Usual labor for lifting buckets. | Average area per lift in acres. Kharif. | Rabi. | Total. | Remarks. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 |
| 528 | W. P. | CAWNPORE. | Bithúr, .. | Bithúr, .. | 1879-80 | 2398·0 | 14·0 | 16·4 | 69·6 | 286·5 | 1955 | 18·0 | 82·0 | 0·5 | .. | 0·4 | 40·0 | 40·9 | 8·1 | .. | 9·0 | 42·0 | 59·1 | 1 *p*-3 2 *p*-3 | 1 *p*-10 | 1 *p*-51 | 67 | 70 | .. | 70 | Bullock, | 0·11 | 2·27 | 2·38 | |
| 530 | N. | CAWNPORE. | „ .. | „ .. | 80-81 | 2398·0 | 14·3 | 15·7 | 70·0 | 143·3 | 1822 | 26·9 | 73·1 | 0·8 | .. | 0·4 | 41·1 | 42·3 | 11·2 | .. | 14·5 | 32·0 | 57·7 | 1 *p*-3 2 *p*-3 | 1 *p*-10 | 1 *p*-46 | 62 | 65 | .. | 65 | „ | 0·20 | 3·15 | 3·35 | In '81-82 many wells failed. |
| 535 | | UNAO. | Unao, .. | Unao, .. | 79-80 | 4597·0 | 21·2 | 30·9 | 47·9 | 361·5 | 2563·5 | 73·4 | 26·6 | .. | .. | 38·0 | 17·1 | 55·1 | 19·9 | .. | 15·5 | 9·5 | 44·9 | 82 | .. | 125 | 207 | 215 | .. | 215 | „ | .. | 2·37 | 2·37 | |
| | | | „ .. | „ .. | 80-81 | 4597·0 | 21·2 | 40·9 | 37·9 | 72·0 | 1813 | 63·6 | 36·4 | 4·3 | .. | 29·9 | 36·4 | 70·6 | 29·4 | .. | .. | .. | 29·4 | 82 | .. | 136 | 218 | 225 | .. | 225 | „ | 0·35 | 2·37 | 2·72 | |
| 542 | | | Mona, .. | Duryaganj, .. | 79-80 | 672·5 | 30·6 | 33·4 | 36·0 | 6·75 | 248·25 | 98·7 | 1·3 | .. | .. | 23·7 | 0·7 | 24·4 | 3·6 | .. | 72·0 | 0·6 | 75·6 | 3 | 1 | 10 | 14 | .. | 5 | 5 | Men, | .. | 1·5 | 1·5 | |
| | | | „ .. | „ .. | 80-81 | 672 5 | 28 8 | 32·5 | 38·7 | 5·05 | 265·55 | 24·5 | 75·5 | .. | .. | 3·5 | 5·4 | 8·9 | 3·9 | .. | 17·1 | *70·1 | 91·1 | 3 | 1 | 30 | 34 | .. | 5 | 5 | „ | .. | 2·06 | 2·06 | * Crop failed. |
| 552 | OUDH. | LUCKNOW. | Lucknow, .. | Banthra, .. | 79-80 80-81 | 1192·8 | 35·0 | 11 0 | 54·0 | 21·1 | 665·1 | 26·9 | 73·1 | 0·4 | .. | .. | 58·1 | 58·5 | 22·4 | .. | 4·5 | 14·6 | 41·5 | 1 | .. | 26 | 27 | 20 | 6 | 26 | Bullock and Men, | 0·11 | 5·73 | 5·84 | |
| 568 | | | „ .. | Hamirpur, .. | 79-80 80-81 | 631·0 | 31·4 | 17·4 | 51·2 | 24 | 346·7 | 23·2 | 76·8 | 2·2 | .. | 0·6 | 62·0 | 64·8 | 10·6 | .. | 9·8 | 14·8 | 35·2 | 1 | .. | 3 | 4 | 1 | 3 | 4 | Men and | 1·94 | 9·14 | 11·08 | |
| 572 | | | Malihabad, .. | Malihabad, .. | 79-80 | 1611·5 | 20·0 | 30·2 | 49·8 | 46 | 849·35 | 44·4 | 55·6 | 1·8 | .. | 0·3 | 38·7 | 40·8 | 37·7 | 0·4 | 4·2 | 10·9 | 59·2 | 42 | 15 | 29 | 86 | 69 | .. | 69 | Cattle, | 0·23 | 4·64 | 4·87 | |

TABLE A.—*Observation and Experiment*—(Continued).

| DESCRIPTIVE. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | *Date.* | | | | *Class.* | *Cost.* | | | | | | | *Supply.* | *Quality.* | *Substratum.* | *Cultivators on well.* | | *Labor and cost per day in annas* | | | | | | | | | | | | |
| Serial Number. | Day. | Month. | Year. | Number of Well. | | Construction. | Fittings. | Total. | Renewal. | Lifts. | Yearly repairs. | Total. | | | | Number. | Caste. | Men, home. | Do. hired. | Rate, per day. | Cattle. | Cost for men. | Do. for cattle. | Total cost, per day. | | | | | | |
| 37 | 38 | 39 | 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 | 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 | 61 | | | | | | |
| 524 | .. | .. | .. | 266/2 | Kucha unlined, very old, .. | .. | 1/- | 1/- | .. | 1/- | .. | 1/- | Spring, .. | Sweet, .. | Clay, .. | .. | Kachi, | 2 | 1 | ·5 | .. | 1·5 | .. | -/1/6 | | | | | | |
| 526 | .. | .. | .. | 262 | „ „ .. | .. | 1/- | 1/- | .. | 1/- | .. | 1/- | „ .. | „ .. | „ .. | .. | „ | | | | | | | | | | | | | |
| 528 | 16 | 4 | 82 | 853 | Kucha lined with wood, .. | .. | .. | .. | .. | .. | .. | .. | „ .. | „ .. | „ 75', | 2 | „ | 2 | 1 | 2·0 | 2 | 3 | 3 | -/6/- | | | | | | |
| | | | | | | | | | | | | | | | | 1 | Herdsman, | | | | | | | | | | | | | |
| 533 | 16 | 4 | 82 | 859 | „ „ .. | .. | .. | .. | .. | .. | .. | .. | „ .. | „ .. | „ | 1 | Kachi, | 3 | .. | .. | 2 | 2 | 3 | -/5/- | | | | | | |
| | | | | | | | | | | | | | | | | 1 | Kurmi, | | | | | | | | | | | | | |
| 535 | 20 | 12 | 81 | .. | Masonry, .. | 150/- | 3/- | 153/- | .. | 5/- | 1/- | 6/- | „ .. | „ .. | „ 43', .. | 1 | Pathan, .. | .. | 3 | 1·5 | 2 | 4·6 | 3·0 | -/7/6 | | | | | | |
| 537 | .. | .. | .. | .. | Kucha, .. | 6/- | 21/- | 10/- | .. | 4/- | 2/- | 10/- | „ .. | „ .. | „ .. | 2 | Lodhas, .. | 3 | .. | .. | 4 | 2 | 6 | -/8/- | | | | | | |
| 539 | .. | .. | .. | .. | „ .. | 6/- | 4/- | 10/- | .. | 4/- | 2/- | 6/- | „ .. | „ .. | „ .. | 1 | Musalman, .. | .. | .. | .. | .. | .. | .. | .. | | | | | | |
| 540 | .. | .. | .. | .. | „ .. | 6/- | 4/- | 10/- | .. | 4/- | 2/- | 6/- | Percolation, | „ .. | „ .. | 1 | Kachi, .. | 3 | .. | .. | 4 | 2 | 6 | -/8/- | | | | | | |
| 542 | 21 | 12 | 81 | .. | „ .. | 2/- | 1/- | 3/- | 1/- | 1/- | .. | 2/- | „ .. | „ .. | Sand, .. | 1 | Mahajun, .. | 2 | 2 | 2·0 | .. | 5 | .. | -/5/- | | | | | | |
| 545 | .. | .. | .. | .. | „ .. | 2/- | 1/- | 3/- | 1/- | 1/- | .. | 2/- | „ .. | „ .. | „ .. | 2 | Kachis, .. | 4 | .. | .. | .. | 3 | .. | -/3/- | | | | | | |
| 549 | .. | .. | .. | .. | „ .. | 2/- | 1/- | 3/- | 1/- | 1/- | .. | 2/- | „ .. | „ .. | „ .. | 1 | Lodha, .. | 3 | .. | .. | .. | 2 | .. | -/2/- | | | | | | |
| 552 | 22 | .. | .. | .. | Kucha unlined, 10 years' old, | 5/- | 3/- | 8/- | .. | 4/- | 1/- | 5/- | Spring, .. | „ .. | Clay, .. | 1 | Brahmin, .. | 3 | .. | .. | 3 | 2 | 4·5 | -/6/6 | | | | | | |
| 555 | 23 | 12 | 81 | .. | Masonry, old, .. | 150/- | 3/- | 153/- | .. | 4/- | 1/- | 5/- | „ .. | „ .. | „ .. | 10 | Chamars, .. | 8 | .. | .. | .. | 7 | .. | -/7/- | | | | | | |
| 559 | 23 | 12 | 81 | .. | Kucha lined, .. | 3/- | 2/- | 5/- | 3/- | 4/- | .. | 7/- | „ .. | „ .. | „ .. | *x* | Kachis, .. | 3 | .. | .. | 4 | 2 | 6 | -/8/- | | | | | | |
| 563 | 23 | 12 | 81 | .. | „ „ .. | 3/- | 2/- | 5/- | 3/- | 4/- | .. | 7/- | „ .. | „ .. | „ .. | *x* | „ .. | 8 | .. | .. | .. | 7 | .. | -/7/- | | | | | | |
| 566 | .. | .. | .. | .. | „ „ .. | 3/- | 2/- | 5/- | 3/- | 4/- | .. | 7/- | „ .. | „ .. | „ .. | 3 | „ .. | 5 | .. | .. | .. | 4 | .. | -/4/- | | | | | | |
| 568 | 23 | 12 | 81 | .. | Masonry, old, .. | 150/- | 3/- | 153/- | .. | 4/- | 1/- | 5/- | „ .. | „ .. | „ .. | 7 | Thakurs .. | .. | 10 | 1·4 | .. | 14 | .. | -/14/- | | | | | | |
| 572 | 3 | 1 | 82 | .. | Dry brick, .. | 27/- | 3/- | 30/- | .. | 5/- | 1/- | 6/- | Percolation, | „ .. | Sand, .. | 1 | Pathan, .. | 1 | 2 | .. | 2 | 3 | 3 | -/6/- | | | | | | |

TABLE A.—*Observation and Experiment*—(Continued).

EXPERIMENTAL.

| Serial Number. | Run. Class. | Run. Pairs of cattle to each lift. | Lift. Number. | Lift. Content in cubic feet. | Depth to Wells. Morning. | Depth to Wells. Evening. | Depth to Wells. Mean. | Soil. | COMMAND. *Kharif* 1881-82. Crop. | Wateringsrequired. | Area. | Total area reduced to one watering. | No. of days to area. | COMMAND. *Rabi* 1881-82. Crop. | Wateringsrequired. | Area. | Total area reduced to one watering. | No. of days to area. | AREA IRRIGATED TO DATE. *Kharif* 1881-82. Crop. | Wateringsgiven. | Area. | Working days to date. | Duty. Per lift. | Duty. Per pair. | *Rabi* 1881-82. Crop. | Wateringsgiven. | Area. | Working days to date. | Duty. Per lift. | Duty. Per pair. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 62 | 63 | 64 | 65 | 66 | 67 | 68 | 69 | 70 | 71 | 72 | 73 | 74 | 75 | 76 | 77 | 78 | 79 | 80 | 81 | 82 | 83 | 84 | 85 | 86 | 87 | 88 | 89 | 90 | 91 |
| 524 | Ráti, .. | .. | 4 | 0·4 | 23 | 25 | 24 | Matyar, .. | Sugar, .. | .. | .. | .. | .. | Garden, .. | 20 | 2·32 | 46·4 | 269 | Sugar, .. | .. | .. | .. | .. | .. | Garden, .. | *x* | 2·32 | .. | ·087 | .. |
| 528 | Lagor, .. | 1 | 1 | 2·64 | 47 | 50 | 48·5 | Dumat, .. | „ .. | .. | .. | .. | .. | Potatoes, .. | 12 | 0·5 | 40 | 224 | „ .. | .. | .. | .. | .. | .. | Potatoes, .. | 12 | 0·5 | 24 | 0·250 | 0·250 |
| | | | | | | | | | | | | | | Tobacco, .. | 12 | 1·0 | | | | | | | | | Tobacco, .. | 12 | 1·0 | 60 | 0·200 | 0·200 |
| | | | | | | | | | | | | | | Garden, .. | 10 | 1·6 | | | | | | | | | Garden, .. | 8 | 1·6 | 56 | 0·228 | 0·228 |
| | | | | | | | | | | | | | | Wheat, .. | 4 | 1·5 | | | | | | | | | Wheat, .. | 4 | 1·5 | 24 | 0·250 | 0·250 |
| 533 | „ .. | 1 | 1 | 2·59 | 48 | 57 | 52·5 | „ .. | „ .. | .. | .. | .. | .. | Tobacco, .. | 12 | 1·7 | 40·8 | 216 | „ .. | .. | .. | .. | .. | .. | Tobacco, .. | 10 | 1·7 | 65 | ·261 | ·261 |
| | | | | | | | | | | | | | | Potatoes, .. | 12 | 1·7 | | | | | | | | | Wheat, .. | 12 | 1·7 | 78 | ·261 | ·261 |
| 535 | „ .. | 1 | 1 | .. | 35 | 41 | 38 | „ .. | „ .. | .. | .. | .. | .. | Wheat, .. | 4 | 1·27 | 50·8 | 127 | „ .. | .. | .. | .. | .. | .. | „ .. | 0·5 | 1·27 | 10 | ·063 | ·063 |
| 537 | „ .. | 1 | 2 | .. | 31 | .. | .. | „ .. | „ .. | .. | .. | .. | .. | „ .. | 4 | 2·934 | 11·73 | 67 | „ .. | .. | .. | .. | .. | .. | „ .. | 1 | 2·0 | 11·5 | ·087 | ·087 |
| 539 | „ .. | 1 | 1 | .. | 29 | 36 | 32·5 | „ .. | „ .. | .. | .. | .. | .. | „ .. | 4 | 1·891 | 7·56 | 105 | „ .. | .. | .. | .. | .. | .. | „ .. | .. | .. | .. | .. | .. |
| 540 | „ .. | 1 | 1 | .. | 28 | 36 | 32 | „ .. | „ .. | .. | .. | .. | .. | „ .. | 4 | 3·083 | 12·33 | 172 | „ .. | .. | .. | .. | .. | .. | „ .. | 1 | 1·0 | 14 | ·071 | ·071 |
| 542 | „ .. | Men 2 | 1 | .. | .. | 20 | .. | Matyar, .. | „ .. | .. | .. | .. | .. | „ .. | 3 | 0·70 | 2·1 | 45 | „ .. | .. | .. | .. | .. | .. | „ .. | 1 | 0·7 | 12 | ·060 | .. |
| 545 | „ .. | .. | 1 | .. | .. | 20 | .. | „ .. | „ .. | .. | .. | .. | .. | „ .. | 4 | ·270 | | | | | | | | | „ .. | 1 | ·274 | | | |
| | | | | | | | | | | | | | | Opium, .. | 10 | ·548 | 14 | 266 | „ .. | .. | .. | .. | .. | .. | Opium, .. | 1 | ·548 | .. | .. | .. |
| | | | | | | | | | | | | | | Garden, .. | 15 | ·500 | | | | | | | | | Garden, .. | *x* | ·500 | | | |
| 549 | „ .. | .. | 1 | .. | .. | 20 | .. | „ .. | „ .. | .. | .. | .. | .. | Wheat, .. | 4 | 0·3 | 3·2 | 80 | „ .. | .. | .. | .. | .. | .. | Wheat, .. | 1 | 0·3 | 15 | ·033 | .. |
| | | | | | | | | | | | | | | Opium, .. | 10 | 0·2 | | | | | | | | | Opium, .. | 1 | 0·2 | | | |
| 552 | „ .. | 1·5 | 1 | 2·025 | 20 | 24 | 22 | Dumat, .. | „ .. | .. | 1·8 | .. | .. | Wheat, .. | 3 | 3·76 | 11·28 | 146 | „ .. | .. | .. | .. | .. | .. | Wheat, .. | 1 | 3·76 | 27 | ·140 | ·073 |
| 555 | „ .. | Men 6 | 1 | 1·4625 | .. | 30 | .. | „ .. | „ .. | .. | .. | .. | .. | Barley, .. | 2 | 2·125 | | | | | | | | | Barley, .. | | | | | |
| | | | | | | | | | | | | | | Wheat, .. | 2 | 9·90 | 30 | 81 | „ .. | .. | .. | .. | .. | .. | Wheat, .. | 1 | 5·625 | 18 | ·312 | .. |
| | | | | | | | | | | | | | | Opium, .. | 10 | 0·625 | | | | | | | | | Opium, .. | | | | | |
| 559 | „ .. | 2 | 1 | .. | .. | 24·5 | .. | „ Matyar, | „ .. | .. | .. | .. | .. | Barley, .. | 2 | 1·3 | | | | | | | | | Barley, .. | | | | | |
| | | | | | | | | | | | | | | Wheat, .. | 2 | 7·15 | 43 | 116 | „ .. | .. | .. | .. | .. | .. | Wheat, .. | 1 | 6·25 | 17 | ·367 | ·183 |
| | | | | | | | | | | | | | | Opium, Garden, | 5 | 5·2 | | | | | | | | | Opium, Garden, | | | | | |
| 563 | „ .. | Men 7 | 1 | .. | .. | 25 | .. | „ .. | „ .. | .. | .. | .. | .. | Barley, .. | 2 | 4·0 | 16·0 | 74 | „ .. | .. | .. | .. | .. | .. | Barley, .. | 1 | 4·0 | 37 | ·216 | .. |
| | | | | | | | | | | | | | | Wheat, .. | 2 | 4·0 | | | | | | | | | Wheat, .. | 1 | 4·0 | | | |
| 566 | „ .. | .. | 1 | .. | .. | 24 | .. | Dumat, .. | „ .. | .. | .. | .. | .. | Opium, .. | 5 | 1·54 | 7·7 | 70 | „ .. | .. | .. | .. | .. | .. | Opium, .. | 1 | 0·66 | 6 | ·110 | .. |
| 568 | „ .. | .. | 1 | 2·5875 | 17 | 17 | 17 | Matyar, Dumat, | „ .. | .. | .. | .. | .. | Barley, .. | 2 | 5·28 | | | | | | | | | Barley, .. | 1 | 3·00 | | | |
| | | | | | | | | | | | | | | Wheat, .. | 3 | 9·00 | 4·8 | 89 | „ .. | .. | .. | .. | .. | .. | Wheat, .. | 1 | 7·00 | 40 | ·254 | .. |
| | | | | | | | | | | | | | | Opium, .. | 5 | 2·10 | | | | | | | | | Opium, .. | 1 | 1·58 | | | |
| 572 | „ .. | 1 | 1 | .. | 30 | 40 | 35 | Matyar, .. | „ .. | .. | .. | .. | .. | Wheat, .. | 3 | 2·5 | 7·5 | 68 | „ .. | .. | .. | .. | .. | .. | Wheat, .. | 1 | 2·5 | 27 | ·092 | ·092 |

TABLE A.—*Observation and Experiment*—(Continued).

| Serial Number. | EXPERIMENTAL. WORK. Duration of work, minutes. | No. of lifts. | Cubic feet lifted. Per pair of cattle, per hour. | Per lift, per hour. | Total per well. | H. P. Per bullock. | Total per well. | Length of watercourse. | Area Irrigated. Crop. | Watering. | Interval. | Area in square feet. | Depth. On area. | Of damp. | Days to an Acre. Per pair of cattle. | Per lift. | Per well. | Duty per pair. | COST. Annual. Interest at 5 p. c. | Repairs, &c. | Total. | Per Acre. Per acre irrigated. | Lifting. | Total. | Remarks. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 92 | 93 | 94 | 95 | 96 | 97 | 98 | 99 | 100 | 101 | 102 | 103 | 104 | 105 | 106 | 107 | 108 | 109 | 110 | 111 | 112 | 113 | 114 | 115 | 116 |
| 524 | 400 | 2,263 | .. | 69 | 905 | Per man ·785 | 314 | 150 | Garden, .. | .. | .. | 7,590 | ·12 | ·70 | .. | 11·5 | 11·5 | .. | 0·1 | 2·0 | 2·1 | | | | 2 wells together. |
| 528 | 527 | 384 | 115 | 115 | 1,014 | 1·567 | 826 | 270 | Tobacco, .. Garden, .. | 12 8 | 12 days, .. | 7,550 | ·13 | ·75 | ·56 | 5·6 | 5·6 | .. | .. | .. | .. | | | | Area double cropped. |
| 533 | 530 | 456 | 133 | 133 | 1,181 | 2·095 | 1,110 | 160 | Tobacco, .. | 10 | 12 days, | 8,165 | ·14 | ·70 | 5·3 | 5·3 | 5·3 | .. | .. | .. | .. | | | | „ „ „ |
| 535 | .. | .. | .. | .. | .. | .. | .. | .. | Wheat, .. | 1 | .. | 1,720 | .. | .. | 25 | 25 | 25 | .. | 5·1 | 6·0 | 11·1 | | | | Water short. |
| 537 | .. | .. | .. | .. | .. | .. | .. | .. | „ .. | 1 | .. | 7,660 | .. | .. | 11·4 | 11·4 | 5·7 | .. | 0·5 | 10·0 | 10·5 | | | | |
| 539 | .. | .. | .. | .. | .. | .. | .. | 860 | „ .. | 1 | .. | 6,000 | .. | .. | 14 | 14 | 14 | .. | 1·0 | 12·0 | 13·0 | | | | |
| 540 | .. | .. | .. | .. | .. | .. | .. | 420 | | | | | | | | | | | | | | | | | |
| 542 | .. | .. | .. | .. | .. | .. | .. | 500 | „ .. | 1 | .. | 1,400 | .. | .. | .. | 30 | 30 | .. | 0·2 | 2·0 | 2·2 | | | | |
| | | | | | | | | 150 | „ .. | 1 | .. | 3,140 | .. | .. | .. | 13 | 13 | | | | | | | | |
| 545 | 480 | .. | .. | .. | .. | .. | .. | 300 | Opium, .. | 1 | .. | 2,250 | .. | .. | .. | 19 | 19 | .. | 0·2 | 2·0 | 2·2 | | | | |
| 549 | .. | .. | .. | .. | .. | .. | .. | 200 | Wheat, .. Opium, .. | 1 1 | .. | 1,702 | .. | .. | .. | 25 | 25 | .. | 0·2 | 2·0 | 2·2 | | | | |
| 552 | 630 | 591 | 80 | 118 | 1,197 | ·495 | 312 | 400 | Wheat, .. | 1 | .. | 5,000 | ·239 | .. | 13·0 | 8·7 | 8·7 | .. | 0·4 | 5·0 | 5·4 | | | | |
| 555 | 660 | 1,262 | .. | 168 | 1,845 | Per man ·472 | 311 | 1,300 | „ .. | 1 | .. | 16,000 | ·115 | .. | .. | 2·7 | 2·7 | .. | 7·6 | 5·0 | 12·6 | | | | |
| 559 | .. | .. | .. | .. | .. | .. | .. | x | „ .. | 1 | .. | 16,000 | .. | .. | 5·4 | 2·7 | 2·7 | .. | 0·3 | 7·0 | 7·3 | | | | |
| 563 | .. | .. | .. | .. | .. | .. | .. | x | Barley, .. Wheat, .. | 1 1 | .. | 9,408 | .. | .. | .. | 4·6 | 4·6 | .. | 0·3 | 7·0 | 7·3 | | | | |
| 566 | .. | .. | .. | .. | .. | .. | .. | .. | Opium, .. | 1 | .. | 4,850 | .. | .. | .. | 9 | 9 | .. | 0·3 | 7·0 | 7·3 | | | | |
| 568 | 750 | 1,920 | .. | 397 | 4,968 | Per man ·440 | 330 | 790 | Wheat, .. | 1 | .. | 24,000 | ·211 | .. | .. | 1·81 | 1·81 | .. | 7·6 | 5·0 | 12·6 | | | | |
| 572 | .. | .. | .. | .. | .. | .. | .. | 330 | „ .. | 1 | .. | 4,754 | .. | .. | 9 | 9 | 9 | .. | 1·5 | 6·0 | 7·5 | | | | |

TABLE A.—*Observation and Experiment*—(Continued).

STATISTICAL.

| Serial Number. | Locality. | | | | Year. | Area in Acres. | | | Cultivated Area. | | | Percentage of Total Cultivated Area. | | | | | | | | | | | Irrigation Wells. | | | | Lifts. | | | Usual labor for lifting buckets. | Average area per lift, in acres. | | | Remarks. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Province. | District. | Pergunna. | Village. | | Actual area in acres. | Percentage uncultivated. | | Percentage of actual area cultivated. | Double cropped area in acres. | Total area actually cultivated in the year. | Wet. | Dry. | Kharif. | | | | | Rabi. | | | | | Lime masonry. | Dry bricks. | Kacha. | Total. | Leather bucket. | Earthen pots. | Total. | | Kharif. | Rabi. | Total. | |
| | | | | | | | Waste. | Culturable. | | | | | | Wet. | | | Dry. | Total. | Wet. | | | Dry. | Total. | | | | | | | | | | | |
| | | | | | | | | | | | | | | Wells. | Canals. | Other sources. | | | Wells. | Canals. | Other sources. | | | | | | | | | | | | |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 |
| 574 | | | Malihabad, .. | Malihabad, .. | 1880-81 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | |
| 578 | H. | LUCKNOW. | „ .. | Rahimganj, .. | 79-80 | 1717·0 | 12·0 | 6·3 | 81·7 | 29·6 | 170·0 | 41·7 | 58·3 | 3·5 | .. | .. | 49·5 | 53·0 | 37·9 | .. | 0·3 | 8·8 | 47·0 | 7 | .. | 25 | 32 | 300 | .. | 30 | Men, Cattle, | 0·19 | 2·1 | 2·29 | Number of lifts doubtful. |
| 579 | | | „ .. | „ .. | 80-81 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | |
| 588 | D | | Sandilla, .. | Sandilla, .. | 79-80 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | |
| | U | | | | 80-81 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | |
| 593 | | | „ .. | Gonsganj, .. | 79-80 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | |
| | O | | | | 80-81 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | |
| 602 | | HARDUL. | Bilgram, .. | Ansanpur, .. | 79-80 | 253·5 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | Area subject to Ganges flood. |
| | | | „ .. | „ .. | 80-81 | 253·5 | 4·8 | 11·6 | 83·6 | 10·1 | 221·8 | 8·2 | 91·8 | .. | .. | .. | 33·2 | 33·2 | 8·2 | .. | .. | 58·6 | 66·8 | .. | .. | 11 | 11 | .. | 11 | 11 | .. | .. | 1·66 | 1·66 | |

TABLE A.—*Observation and Experiment*—(Continued).

| DESCRIPTIVE. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Serial Number. | *Date.* | | | Number of Well. | *Class.* | *Cost.* | | | | | | | *Supply.* | *Quality.* | *Substratum.* | *Cultivators on well.* | | *Labor and cost per day in annas.* | | | | | | | | | | | | | | |
| | Day. | Month. | Year. | | | Construction. | Fittings. | Total. | Renewal. | Lifts. | Yearly repairs. | Total. | | | | Number. | Caste. | Men, home. | Do. hired. | Rate, per day. | Cattle. | Cost for men. | Do. for cattle. | Total cost, per day. | | | | | | | | |
| 37 | 38 | 39 | 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 | 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 | 61 | | | | | | | | |
| 574 | 3 | 1 | 82 | .. | Dry brick, .. | 27/- | 3/- | 30/- | .. | 5/- | 1/- | 6/- | Spring, .. | Sweet, .. | Clay, .. | 1 | Kachi, .. | 4 | .. | .. | 4 | 3 | 6 | -/9/- | | | | | | | | |
| 578 | 4 | 1 | 82 | .. | „ „ .. | 27/- | 3/- | 30/- | .. | 5/- | 1/- | 6/- | „ .. | „ .. | „ .. | 3 | Ahirs, .. | 2 | 1 | 1·5 | 4 | 2·5 | 6 | -/8/6 | | | | | | | | |
| 581 | 4 | 1 | 82 | .. | „ „ .. | 27/- | 3/- | 30/- | .. | 5/- | 1/- | 6/- | „ .. | „ .. | „ .. | 7<br>1 | „<br>Brahmin, | 8 | .. | .. | .. | 7 | .. | -/7/- | | | | | | | | |
| 584 | 4 | 1 | 82 | .. | Kucha, .. | 6/- | 3/- | 9/- | 2/- | 5/- | 1/- | 8/- | „ .. | „ .. | „ .. | 1 | „ .. | 3 | .. | .. | 4 | 2 | 6 | -/8/- | | | | | | | | |
| 586 | 4 | 1 | 82 | .. | „ .. | 6/- | 3/- | 9/- | 2/- | 5/- | 1/- | 8/- | „ .. | „ .. | „ .. | 1 | „ .. | 3 | .. | .. | 3 | 2 | 4·5 | -/6/- | | | | | | | | |
| 588 | 5 | 1 | 82 | .. | Masonry, .. | 150/- | 3/- | 153/- | .. | 4/- | 1/- | 5/- | „ .. | „ .. | „ .. | 1 | Musalman, .. | 2 | 1 | 1·5 | 6 | 3·5 | 9 | -/12/6 | | | | | | | | |
| 590 | .. | .. | .. | .. | Dry brick, . | 20/- | 3/- | .. | .. | .. | .. | .. | „ .. | „ .. | „ .. | 1 | „ .. | .. | 9 | 1·5 | .. | 13·5 | .. | -/13/6 | | | | | | | | |
| 591 | .. | .. | .. | .. | Kucha, .. | 5/- | 3/- | 31/- | 2/- | 4/- | 2/- | 12/- | „ .. | „ .. | „ .. | .. | „ .. | .. | 3 | 1·5 | 4 | 4·5 | 6 | -/10/6 | | | | | | | | |
| 593 | 6 | 1 | 82 | .. | „ lined, .. | 1/- | 0·5 | 1·5 | 1/- | 1/- | .. | 2/- | Percolation, | „ .. | Sand, | 1<br>1 | Kachi,<br>Brahmin, | 2 | .. | .. | .. | 1 | .. | -/1/- | | | | | | | | |
| 596 | .. | .. | .. | .. | 2 „ „ .. | 2/- | 1/- | 3/- | 2/- | 1/- | .. | 4/- | „ .. | „ .. | „ .. | 3 | Kurmis, .. | 3 | .. | .. | .. | 2 | .. | -/2/- | | | | | | | | |
| 598 | .. | .. | .. | .. | 2 „ „ .. | 2/- | 1/- | 3/- | 2/- | 1/- | .. | 4/- | „ .. | „ .. | „ .. | .. | „ .. | 3 | .. | .. | .. | 2 | .. | -/2/- | | | | | | | | |
| 600 | .. | .. | .. | .. | 7 „ „ .. | 7/- | 3/- | 10/- | 7/- | 1/- | .. | 14/- | „ .. | „ .. | „ .. | .. | „ .. | 8 | .. | .. | .. | 7 | .. | -/7/- | | | | | | | | |
| 602 | 7 | 1 | 82 | .. | 2 „ „ .. | 2/- | 1/- | 3/- | 2/- | ·5 | .. | 3/- | „ .. | „ .. | „ .. | 2 | Kachis, .. | 3 | .. | .. | .. | 2 | .. | -/2/- | | | | | | | | |
| 605 | .. | .. | .. | .. | 1 „ „ .. | 1/- | 0·5 | 1·5 | 1/- | 0·5 | .. | 1·5 | „ .. | „ .. | „ .. | 1 | „ .. | 2 | .. | .. | .. | 1 | .. | -/1/- | | | | | | | | |
| 608 | 8 | .. | .. | .. | 3 „ „ .. | 2/- | 2/- | 4/- | 2/- | 2/- | .. | 4/- | „ .. | „ .. | „ .. | 2<br>2 | Brahmins, ..<br>Lohars, .. | 2<br>2 | .. | .. | .. | 1<br>1 | .. | -/1/-<br>-/1/- | | | | | | | | |

TABLE A.—*Observation and Experiment*—(Continued).

| Serial Number. | EXPERIMENTAL. | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | *Run.* | | *Lift.* | | *Depth to Wells.* | | | | COMMAND. | | | | | | | | | AREA IRRIGATED TO DATE. | | | | | | | | | | |
| | | | | | | | | | *Kharif* 1881-82. | | | | | *Rabi* 1881-82. | | | | *Kharif* 1881-82. | | | | | | *Rabi* 1881-82. | | | | | |
| | Class. | Pairs of cattle to each lift. | Number. | Content in cubic feet. | Morning. | Evening. | Mean. | Soil. | Crop. | Waterings required. | Area. | Total area reduced to one watering. | No. of days to area. | Crop. | Waterings required. | Area. | Total area reduced to one watering. | No. of days to area. | Crop. | Waterings given. | Area. | Working days to date. | *Duty.* Per lift. | *Duty.* Per pair. | Crop. | Waterings given. | Area. | Working days to date. | *Duty.* Per lift. | *Duty.* Per pair. |
| | 62 | 63 | 64 | 65 | 66 | 67 | 68 | 69 | 70 | 71 | 72 | 73 | 74 | 75 | 76 | 77 | 78 | 79 | 80 | 81 | 82 | 85 | 84 | 85 | 86 | 87 | 88 | 89 | 90 | 91 |
| 574 | Lagor, .. | 2 | 1 | .. | 30 | 40 | 35 | Matyar, .. | Sugarcane, | 8 | 1·06 | 8·48 | 40 | Wheat, .. | 3 | 2·25 | 16 | 75 | Sugar, .. | x | 1·06 | ·5 | ·213 | ·106 | Wheat, .. | x | 2·25 | | | |
| | | | | | | | | | | | | | | Opium, .. | 6 | 0·46 | | | | | | | | | Opium, .. | x | 0·46 | 16 | ·213 | ·106 |
| | | | | | | | | | | | | | | Potatoes, .. | 9 | 0·7 | | | | | | | | | Potatoes, .. | x | 0·7 | | | |
| 578 | „ .. | 2 | 1 | 2·25 | 29 | 34 | 31·5 | „ .. | „ .. | 12 | 0·51 | 6·12 | .. | Wheat, .. | 3 | 4·3 | 14 | 88 | „ .. | x | 0·51 | 3·5 | ·146 | ·073 | Wheat, .. | x | 4·3 | | | |
| | | | | | | | | | | | | | | Opium, .. | 6 | 0·18 | | | | | | | | | Opium, .. | x | 0·18 | 30 | ·146 | ·073 |
| 581 | „ .. | Men 6 | 1 | 1·5 | 26 | 35 | 30·5 | Dumat, .. | „ .. | .. | .. | .. | .. | Rabi, .. | .. | .. | .. | .. | „ .. | .. | .. | .. | .. | .. | Rabi, .. | .. | .. | .. | ·333 | .. |
| 584 | „ .. | 2 | 1 | 2·07 | 27 | 31 | 29 | „ .. | „ .. | .. | .. | .. | .. | „ .. | .. | .. | .. | .. | „ .. | .. | .. | .. | .. | .. | „ .. | .. | .. | .. | ·147 | ·071 |
| 586 | „ .. | 1·5 | 1 | 1·068 | 27 | 34 | 30·5 | „ .. | „ .. | .. | .. | .. | .. | „ .. | .. | .. | .. | .. | „ .. | .. | .. | .. | .. | .. | „ .. | .. | .. | .. | ·091 | ·060 |
| 588 | „ .. | 3 | 1 | 2·59 | 20 | 30 | 25 | Matyar, .. | „ .. | 8 | 2·0 | 16·0 | .. | Wheat, .. | 2 | 5·3 | 10·6 | 53 | „ .. | x | 2·0 | 10 | ·200 | ·67 | Wheat, .. | 1 | 5·3 | 26·5 | ·200 | ·067 |
| 590 | „ .. | Men 7 | 1 | 2·25 | 22 | 38 | 30 | „ .. | „ .. | .. | .. | .. | .. | „ .. | 2 | 7·0 | 14·0 | 104 | „ .. | .. | .. | .. | .. | .. | „ .. | 1 | 7·0 | 52 | ·134 | .. |
| 591 | „ .. | 2 | 1 | .. | 20 | 30 | 25 | „ .. | „ .. | .. | .. | .. | .. | Garden, .. | 5 | 1·4 | 7 0 | 175 | „ .. | .. | .. | .. | .. | .. | Garden, .. | x | 1·4 | 35 | ·040 | ·026 |
| 593 | Ráti, .. | .. | 2 | .. | 16 | 16 | 16 | Dumat, .. | „ .. | .. | .. | .. | .. | Wheat, .. | 2 | 2·8 | 5·6 | 56 | „ .. | .. | .. | .. | .. | .. | Wheat, .. | 1 | 1·87 | 17 | ·110 | .. |
| 596 | „ .. | .. | 4 | .. | 16 | 16 | 16 | „ .. | „ .. | .. | .. | .. | .. | „ .. | 2 | 1·56 | 3·12 | 30 | „ .. | .. | .. | .. | .. | .. | „ .. | 1 | 1·56 | 15 | ·052 | .. |
| 598 | „ .. | .. | 4 | .. | 16 | 16 | 16 | „ .. | „ .. | .. | .. | .. | .. | „ .. | 2 | 1·1 | 2·2 | 34 | „ .. | .. | .. | .. | .. | .. | „ .. | 1 | 1·1 | 17 | ·032 | .. |
| 600 | „ .. | .. | 14 | .. | .. | .. | .. | „ .. | „ .. | .. | .. | .. | .. | „ .. | 2 | 7·65 | 15·3 | 46 | „ .. | .. | .. | .. | .. | .. | „ .. | 1 | 7·65 | 23 | ·042 | .. |
| 602 | Dhenklis, .. | .. | 2 | 0·436 | 10 | 10 | 10 | Matyar, .. | „ .. | .. | .. | .. | .. | „ .. | 3 | 3·5 | 14·0 | 140 | „ .. | .. | .. | .. | .. | .. | „ .. | 1 | 3·5 | 20 | ·017 | .. |
| | | | | | | | | | | | | | | Opium, .. | 5 | | | | | | | | | | Opium, | | | | | |
| 605 | „ .. | .. | 1 | 0·394 | 9 | 10 | 9·5 | „ .. | „ .. | .. | .. | .. | .. | Barley, .. | 2 | 1·25 | 8·12 | 114 | „ .. | .. | .. | .. | .. | .. | Barley, | 1 | 1·125 | 16 | ·070 | .. |
| | | | | | | | | | | | | | | Opium, .. | 5 | 1·125 | | | | | | | | | Opium, | | | | | |
| 608 | Ráti, .. | .. | 2 | 0·314 | 10 | 10 | 10 | Dumat, .. | „ .. | .. | .. | .. | .. | Wheat, .. | 2 | 4·16 | 8·32 | 141 | „ .. | .. | .. | .. | .. | .. | Wheat, | x | 416 | 35 | ·060 | .. |
| | 2 Dhenklis, .. | .. | 2 | 0·394 | .. | .. | .. | „ .. | „ .. | .. | .. | .. | .. | Opium, .. | | | | | | | | | | | Opium, | | | | | |

TABLE A.—*Observation and Experiment*—(Continued).

| Serial Number. | EXPERIMENTAL. WORK. Duration of work, minutes. | No. of lifts. | Cubic feet lifted. Per pair of cattle, per hour. | Per lift, per hour. | Total per well. | H. P. Per bullock. | Total per well. | Length of watercourse. | Area Irrigated. Crop. | Watering. | Interval. | Area in square feet. | Depth. On area. | Of damp. | Days to an Acre. Per pair of cattle. | Per lift. | Per well. | Duty per pair. | COST. Annual. Interest at 5 p. c. | Repairs, &c. | Total. | Per Acre. Per acre irrigated. | Lifting. | Total. | Remarks. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 92 | 93 | 94 | 95 | 96 | 97 | 98 | 99 | 100 | 101 | 102 | 103 | 104 | 105 | 106 | 107 | 108 | 109 | 110 | 111 | 112 | 113 | 114 | 115 | 116 |
| 574 | .. | .. | .. | .. | .. | .. | .. | | Wheat, .. | 1 | 30 days, | 9,278 | .. | .. | 9·4 | 4·7 | 4·7 | .. | 1·5 | 6·0 | 7·5 | | | | |
| | | | | | | | | | Opium, .. | 2 | 15 days, | | | | | | | | | | | | | | |
| | | | | | | | | | Potatoes, .. | 3 | 10 days, | | | | | | | | | | | | | | |
| 578 | 540 | 505 | 63 | 126 | 1,136 | ·584 | 315 | 1,120 | Wheat, .. | 2 | 30 days, | 7,290 | ·1558 | .. | 12 | 6·0 | 6·0 | .. | 1·5 | 6·0 | 7·5 | | | | |
| | | | | | | Per man | | | | | | | | | | | | | | | | | | | |
| 581 | 540 | 881 | .. | 146 | 1,321 | ·468 | 264 | 690 | Peas, .. | 2 | .. | 13,500 | ·10 | .. | .. | 3·2 | 3·2 | .. | 1·5 | 6·0 | 7·5 | | | | Supply short. |
| 584 | 570 | 501 | 55 | 110 | 1,037 | ·470 | 265 | 580 | Wheat, .. | 2 | .. | 6,250 | ·17 | .. | 14·0 | 7·0 | 7·0 | .. | 0·5 | 8·0 | 8·5 | | | | |
| 586 | 570 | 438 | 33 | 50 | 468 | ·331 | 189 | 420 | „ .. | 1 | .. | 3,850 | ·1475 | .. | 16·5 | 11 | 11 | .. | 0·5 | 8·0 | 8·5 | | | | |
| 588 | 520 | 501 | 50 | 150 | 1,298 | ·394 | 207 | 510 | „ | 2 | 30 days, | 8,425 | ·154 | .. | 15 | 5 | 5 | .. | 7·6 | 5·0 | 12·6 | | | | |
| | | | | | | Per man | | | | | | | | | | | | | | | | | | | |
| 590 | 550 | 653 | .. | 160 | 1,470 | ·477 | 262 | 505 | „ .. | 1 | .. | 5,866 | ·25 | .. | .. | 7·4 | 7·4 | .. | 1·6 | 12·0 | 13·6 | | | | |
| 591 | .. | .. | .. | .. | .. | .. | .. | .. | Garden .. | x | .. | 1,660 | .. | .. | 50 | 25 | 25 | | | | | | | | |
| 593 | .. | .. | .. | .. | .. | .. | .. | .. | Wheat, .. | 1 | .. | 4,420 | .. | .. | .. | 10 | 10 | .. | 0·1 | 2·0 | 2·1 | | | | |
| 596 | .. | .. | .. | .. | .. | .. | .. | .. | „ .. | 1 | .. | 2,250 | .. | .. | .. | 20 | 20 | .. | 0·2 | 4·0 | 4·2 | | | | |
| 598 | .. | .. | .. | .. | .. | .. | .. | .. | „ .. | 1 | .. | 1,376 | .. | .. | .. | 31 | 31 | .. | 0·2 | 4·0 | 4·2 | | | | |
| 600 | .. | .. | .. | .. | .. | .. | .. | .. | „ .. | 1 | .. | 2,000 | .. | .. | .. | 21 | 21 | .. | 0·5 | 14·0 | 14·5 | | | | |
| | | | | | | Per man | | | | | | | | | | | | | | | | | | | |
| 602 | 390 | 1,242 | .. | 83 | 541 | ·400 | 150 | 130 | Opium, .. | 1 | .. | 4,055 | ·235 | .. | .. | 20 | 20 | .. | 0·2 | 3·0 | 3·2 | | | | |
| | | 996 | .. | 67 | 434 | ·308 | 120 | | | | | | | | | | | | | | | | | | |
| | | | | | | Per man | | | | | | | | | | | | | | | | | | | |
| 605 | 390 | 1,076 | .. | 65 | 424 | ·300 | 114 | 150 | Opium, .. | 1 | .. | 3,077 | ·138 | .. | .. | 14 | 14 | .. | 0·1 | 1·5 | 1·6 | | | | |
| 608 | 630 | 1,721 | .. | 51 | 540 | ·238 | 150 | 120 | Wheat .. | 1 | .. | 2,600 | ·20 | .. | .. | 17 | 17 | .. | .. | .. | .. | | | | |
| | 630 | 1,267 | .. | 47 | 498 | ·219 | 138 | 500 | Opium, .. | 1 | .. | 4,100 | ·12 | .. | .. | 10 | 10 | .. | 0·2 | 4·0 | 4·2 | | | | |

Circular No. 31A.

To

THE SECRETARY TO THE GOVERNMENT OF BOMBAY.

Rev. & Agri. Dept.
*Agriculture.*

*Simla, the 14th May* 1883.

SIR,

I am directed to forward copies of the accompanying letter* reviewing the Report of the Department of Agriculture and Commerce of the North-Western Provinces and Oudh for the year ending the 31st March 1882. The report itself has probably been furnished to you direct by the Local Government, in accordance with the arrangement made by the Circular of this Office, No. 72-A., the 15th December 1882.

*To the Secretary to the Government of the North-Western Provinces and Oudh, No. 445, dated the 14th instant.

2. I am to enquire if His Excellency in Council approve of the arrangement suggested in the last paragraph of the letter herewith forwarded. It will, I am to explain, be convenient to the Government of India, in collecting information regarding the progress made in protective measures by Agricultural Departments throughout India, if some uniform arrangement can be observed in the reports of these Departments. And in this view, the Government of India will be glad to know whether His Excellency in Council will be able to consent to the proposal to which reference is now made, *viz.*, that the annual reports of the Agricultural Departments be divided into the following heads:—

I.—Organization and maintenance of village records.
II.—Analysis of districts.
III.—System of collection of revenue and rental in precarious tracts.
IV.—Measures of protection, including arboriculture.
V.—Agricultural experiments, including farms.
VI.—Introduction of agricultural improvements.
VII.—Collection of statistics, including traffic registration.

I have, &c.,
E. C. BUCK,
*Secretary to the Government of India.*

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No. 445A.

To

THE SECY. TO THE GOVT., N.-W. PROVINCES AND OUDH.

Rev. and Agrl. Dept.
*Agriculture.*

*Simla, the 14th May* 1883.

SIR,

I AM directed to acknowledge the receipt of your letter No. 205, dated 22nd January last, forwarding the report of the Department of Agriculture and Com-

merce, North-Western Provinces and Oudh, for the year ending 31st March 1882, together with the orders thereon by the Local Government.

2. The Government of India is glad to observe from this report that the Agricultural Department in the North-Western Provinces is entrusted with the performance of important duties, and that the main function assigned to it is that upon which most stress is laid in the Resolution of the 8th December 1881, Nos. 6—340-50-G. The utility of what has been termed in that Resolution as agricultural inquiry and economy in the future administration of land settlements depends upon the maintenance and compilation of accurate village statistics. The Government of India is now satisfied that the organization of a village record system under the inspection of a Central Department is essential for this purpose, and cannot too strongly commend that the energies of the Agricultural Department should be concentrated upon this primary section of its duties. Under this view it entirely endorses Sir A. Lyall's recommendation that the Department should for the present confine its attention to some of the more salient points of inquiry or experiment, omitting those which are less immediately important, so as to leave to it ample time and opportunity for the supervision of the village record system.

3. The work of the Department in connection with the maintenance of village statistics being under the immediate control of the Board of Revenue is dealt with in the Board's Annual Administration Report and need not now be noticed further than to remark that as it is presumed that the relative character of the records in each district will be further noticed in that report, the Government of India trusts that notice may then be taken of any conspicuous instance of neglect on the part of district authorities to supervise them, or to enforce the supervision of them by Sadr Kanungos and other officials appointed for the purpose.

4. I am now to request that in the report of the ensuing year or as soon as the North-Western Provinces Government is in a position to communicate the information, the Government of India may be told what subjects are likely to be selected by the Department as the special objects of its attention. In the meanwhile the Government of India desires to indicate those matters which itself it considers of primary importance and which it trusts may sooner or later occupy the special consideration of the Department.

5. The first is the analysis of each district with the view of ascertaining its need for protection against famine. This subject was specially alluded to in the Resolution on suspensions and remissions, dated 12th October 1882, Nos. 58—562-574. The analysis there indicated was, however, not the complete analysis now contemplated. The examination of each district was in that Resolution recommended with the one object of ascertaining the capability of each tract to pay an unfluctuating rental. But an analysis which seeks to ascertain the requirements of each tract for protection against famine needs much further extension. For this more complete purpose it is necessary to draw up comprehensive statements and series of maps showing the products, distribution of population, grazing area, communications, average rainfall, &c., as well as the irrigation of each pargana or Kanungo's circle. It is not intended, nor can it be expected, that any such analysis can be effected within any short period. All that the Government of India desires is that some system should be set on foot by the Agricultural Department under which, as time goes on, such an analysis will be complete. It will consist, the Government of India conceives, mainly in ledgering the statistics of the village records and in reproducing them on pargana or district maps.

6. The organization and maintenance of the village records having been recognized as the initial duty of the Department, that which is indicated in the preceding paragraph appears naturally to form the second step which the Department has to take in advance towards agricultural improvement. For the gradual completion of the analysis which is now demanded will, as time goes on,

lead firstly to the proper adaptation of the revenue system in accordance with the principles laid down in the Resolution, and secondly, to the application of those protective measures the institution of which will more than anything else be conducive to the security of agricultural operations. When these questions have been thoroughly taken up, it will then be time for the Agricultural Department to set about the active introduction of what may be termed positive agricultural improvement such as new machinery or new methods of cultivation.

7. In the meanwhile, however, the Government of India would not like the Agricultural Department to neglect altogether the duties either of making itself acquainted with the character of those improvements which it may be inclined to think it will be useful to introduce eventually to the notice of the agricultural community, or of preparing the agency by means of which it will have to be extended. Many supposed improvements require the careful testing of years before their utility can be thoroughly established. They must be tried in many parts of each province and be placed at first in the hands of those who are competent to give them a careful and intelligent trial. For these reasons the Government of India is desirous that at least one Government experimental farm should be maintained, and that those few of the landholders or cultivators of the province who take a real interest in the subject should be encouraged to associate themselves with the Department in carrying out experiments in their estates, care being taken that the experiments should be neither numerous or complicated, and that they should as a rule be carried on for some few years before any measures are taken by the Department to extend them to any wider circle.

One class of estates to which successful experiments should eventually be carried would, under the policy expressed in a previous communication, be the Court of Wards Estates, and in this view it seems desirable that some steps should sooner or later be taken to train the officials likely to be appointed as managers, in such a manner that the introduction of improvements may be safely entrusted to their hands. The Government of India will be glad if this question may be allowed to receive the consideration of the Board of Revenue and of the Agricultural Department.

8. The remarks which have now been made indicate, it is hoped, clearly the willingness of the Government of India to see the experimental work of the Department and its attempts to introduce positive improvements confined at present within the narrowest limits. It would for instance be willing that the measures commended in its letter No. 228-R. of the 18th May 1882, for the introduction of improvements on Court of Wards Estates should be suspended pending the further trial of experiments elsewhere, and during the institution of some system under which the managers of the Court of Wards Estates may be adequately trained. So also it would deprecate the attention of the Department being given just at present to Agricultural Shows which exhibit a tendency to increase in number and extent, but which can perhaps derive no very great advantage from its assistance, until the Department itself has established a firmer footing. There will be other matters which—without any disparagement of their intrinsic importance—will suggest themselves to His Honour Sir A. Lyall as appertaining to a more remote stage of the Department's operations.

9. There is one class of experiment and improvement, however, which the Government of India would like to see worked out with unremitting attention, viz., that of well irrigation. From the proceedings which have lately been published in connection with this matter, the Government of India regrets to observe that so far as experiments have been tried, a good deal of the expenditure has been attended with unsatisfactory results. The Government of India has, however, reason to believe that the more costly experiments which were first instituted were taken in hand at a time when a Bill had been drafted for the wholesale construction of wells throughout the greater part of the province, and that the experiments were partly intended to ascertain whether the procedure advocated therein was likely to be successful. In this view the experi-

ments had a very serious object which goes some way towards excusing the cost of some of the experimental action.

10. The chief objects, however, which the Government of India desire to see placed in front of all experiments in well irrigation are these:—

(1) whether engineering science can under any circumstances enable natives to make wells in a cheaper manner than they can now make them;

(2) whether engineering science can enable natives to make wells in places in which they cannot now make them;

(3) whether any cheaper or more effective form of lift can be discovered, or can be introduced from one part of the country to another.

If any of these problems can be solved, it is evident that wells can be carried into tracts in which it has hitherto, either from an engineering or a financial point of view, been found impossible to construct them. In either case the results would be so useful as to justify a considerable outlay in an attempt to obtain them.

11. The problems above enumerated have so vast an importance in connection with protection against famine in Northern India that, however hopeless their solution may at first sight appear to be, it seems right to continue to attack them. The Government of India does not itself consider it at all improbable that the science of the Engineering Department will if directed towards the practical questions connected with well irrigation, which have never yet received its thorough attention, succeed in making some advance upon the existing system. It is glad, therefore, to know that the Public Works Department is still associated with the Agricultural Department in the completion of experiments on the Awa estate, and that one of its engineers, Mr. Wilson, has done so much towards bringing into clear light the difficulties and the issues which are involved in the subject. It is indeed to the Public Works Department that the Government must eventually look to give extension to any successful results which may be secured by the experiments under trial.

It is presumed that the Agicultural Department has now sufficient experience to enable it to conduct such experiments with due regard to economy, and the Government of India will await with much interest the reports promised in your 6th paragraph.

12. Turning now to the other subjects noticed in the report, the Government of India is glad to observe that His Honour has been able to acknowledge the utility of the traffic registration effected by the Department. The advantage of abandoning the former attempts to gauge in one year the traffic of the whole province in favour of concentrating attention upon a limited area, appears to have been fully proved.

13. *Manufactures.*—This question has been fully dealt with in Resolution No. 239-E., dated 14th March 1883. If the system set forth in that Resolution can be carried into effect, it will, it may be hoped, relieve the Agricultural Department from some of the personal and executive action which it has hitherto undertaken. Its chief duty would, under the Resolution, be to organize arrangements under which executive action would be the duty of Local Committees and Museum authorities.

14. *Reh.*—The Government of India attaches great importance to the continuance of experiments on Reh land, however little hope there may as yet seem to be for its reclamation. It desires that in the report of next year more particular statistics may be given of the number of plots enclosed, and of the results on any plots in which any class of experiment has been successful.

15. *Arboriculture.*—Mr. Benett's report under this head is very interesting. The success of a plan under which the local officials are entrusted with the independent control of funds realized from the revenues themselves, justifies the anticipations which were expressed some two or three years ago on this sub-

ject. The Government of India is glad that the interest of some native landholders has been enlisted in the maintenance of road avenues, and is pleased also to notice the propress which is being made in this direction. Arboriculture is at the same time a branch of the administration over which careful watch should be kept by Government officials throughout the Province. Its importance in forming an ultimate fodder supply in case of extreme famine should not be overlooked, and in this view the Government of India trusts that the instructions originally laid down by the Provincial Government to confine new planting as far as possible to trees which supply fodder or food may, at any rate in districts liable to famine be attended to. The time may always come when to maintain the lives of cattle the road avenues may have to be surrendered to the exigencies of famine.

16. The only other matter which the Government of India now desires to notice is that of the extension of mulberry planting. If there is any hope at all of the ultimate success of sericulture in the Province, no pains should be spared both in the Agricultural and Forest Departments to extend the plantation of this tree. It is at any time a useful tree to cultivate, and should, in districts likely to be interested in sericulture, form one of the principal road-side trees, in addition to being planted in the neighbourhood of villages.

17. Finally, I am to express the satisfaction of the Government of India with the report of the Department, which is clear and interesting and indicative of earnest endeavours to fulfil the objects set before it. The Government of India endorses the acknowledgments which the North-Western Provinces Government has bestowed on Messrs. Benett, Fuller and Wilson. With reference also to the allusion which has been made in paragraph 6 to the co-operation of native landholders, the Government of India desires that its acknowledgments may be accorded to Pandit Ajudhia Parshad, to Kunwar Harnám Singh, and to the President and Secretary of the Bijnor Agricultural Society, Raja Jaggat Sinha Bahádur and Pandit Sri Lal, for the active steps which they have taken in the direction of agricultural experiment.

18. The Government of India suggests that it may be found convenient with reference to the remarks made in this letter, that the reports of the Agricultural Department, should in future be divided under the heads given below, and will be glad to know if His Honour has any objection to this arrangement:—

I.—Organization and maintenance of village records.
II.—Analysis of districts.
III.—System of collection of revenue and rental in precarious tracts.
IV.—Measures of protection, including arboriculture.
V.—Agricultural experiments, including farms
VI.—Introduction of agricultural improvements.
VII.—Collection of statistics, including traffic registration.

The Government of India will require to be made acquainted with the progress effected throughout India in measures of protection against famine, and will at the same time be glad to learn how far it has, in each year, been found practicable in all Provinces to give effect to the principles suggested in the Resolutions of the 8th December 1881 and 12th October 1882, in accordance with which the arrangement and division of subjects given above have been made generally to conform. It will therefore be convenient if some uniform system such as that above suggested be followed in the reports from Agricultural Departments.

I have, &c.,
E. C. BUCK,
*Secretary to the Government of India.*

# TABLE B.

TABLE B—*Showing the Yearly Area in Acres commanded by Wells in 20 Districts of the North-Western*

| District. | Number. | Depth to water surface. | No. of lifts. | No. of cattle or men lifting. | Class. | RABI. Duty per Well. | RABI. Duty per Lift. | RABI. Duty per Pair. | KHARIF. Duty per Well. | KHARIF. Duty per Lift. | KHARIF. Duty per Pair. | RABI. Wheat. | RABI. Wheat & Barley. | RABI. Wheat & Gram. | RABI. Barley. | RABI. Barley & Gram. | RABI. Barley & Peas. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cawnpore, .. | 533 | 52 | 1 | 2 | Lagor, | 3·40 | 3·40 | 3·40 | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| ,, | 528 | 48 | 1 | 2 | ,, | 4·60 | 4·60 | 4·60 | .. | .. | .. | 1·50 4 | .. | .. | .. | .. | .. |
| ,, | 2 | 42 | 2 | 5 | ,, | 3·50 | 1·75 | 1·40 | 3·20 | 1·60 | 1·33 | .. | 3·50 3 | .. | .. | .. | .. |
| ,, | 3 | 38 | 1 | 2 | ,, | 3·30 | 3·30 | 3·30 | 1·60 | 1·60 | 1·60 | 3·30 3 | .. | .. | .. | .. | .. |
| ,, | 5 | 38 | 1 | 2 | ,, | 2·65 | 2·65 | 2·65 | 1·85 | 1·85 | 1·85 | 2·65 3 | .. | .. | .. | .. | .. |
| ,, | 11 | 37 | 2 | 4 | ,, | *1·00 | 0·50 | 0·50 | .. | .. | .. | 1·00 3 | .. | .. | .. | .. | .. |
| ,, | 37 | 37 | 2 | 4 | ,, | 3·50 | 1·75 | 1·75 | .. | .. | .. | 3·50 3 | .. | .. | .. | .. | .. |
| ,, | 9 | 36 | 2 | 4 | ,, | 3·77 | 1·88 | 1·88 | .. | .. | .. | 2·45 .. | 2 | .. | .. | .. | .. |
| ,, | 13 | 35 | 3 | 6 | ,, | 8·58 | 2·86 | 2·86 | .. | .. | .. | 2·23 3 | .. | .. | .. | .. | 3·45 2 |
| ,, | 8 | 32 | 2 | 4 | ,, | 3·85 | 1·92 | 1·92 | .. | .. | .. | 3·85 4 | .. | .. | .. | .. | .. |
| ,, | 16 | 29 | 1 | 3 | ,, | 3·10 | 3·10 | 2·06 | .. | .. | .. | 3·10 .. | 2 | .. | .. | .. | .. |
| ,, | 21 | 20 | 2 | 4 | ,, | 6·10 | 3·05 | 3·05 | 2·0 | 1·0 | 1·0 | 6·10 .. | 3 | .. | .. | .. | .. |
| ,, | 22 | 20 | 2 | 4 | ,, | 6·10 | 3·05 | 3·05 | 2·0 | 1·0 | 1·0 | 6·10 .. | 3 | .. | .. | .. | .. |
| ,, | 20 | 16 | 1 | 2 | ,, | 1·50 | 1·50 | 1·50 | .. | .. | .. | 1·50 2 | .. | .. | .. | .. | .. |
| Mean, .. | .. | 34 | .. | 3·4 | ,, | 4·15 | 2·68 | 2·57 | 2·13 | 1·41 | 1·35 | 35·5 3 | 38·7 3 | .. | .. | .. | 6·3 2 |
| Hamirpur, .. | 59 | 113 | 1 | 2 | ,, | *0·15 | 0·15 | 0·15 | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| ,, | 60 | 111 | 2 | 4 | ,, | *0·24 | 0·12 | 0·12 | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| ,, | 58 | 88 | 2 | 4 | ,, | *0·32 | 0·16 | 0·16 | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| ,, | 61 | 57 | 1 | 2 | ,, | .. | .. | .. | 2·27 | 2·27 | 2·27 | .. | .. | .. | .. | .. | .. |
| ,, | 45 | 45 | 3 | 6 | ,, | 2 Wells. 9·90 | 3·30 | 3·30 | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| ,, | 47 | 45 | 1 | 2 | ,, | 3·40 | 3·40 | 3·40 | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| ,, | 54 | 42 | 7 | 14 | ,, | 4 Wells. 37·00 | 5·28 | 5·28 | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| ,, | 37 | 41 | 1 | 4 | ,, | *0·90 | 0·90 | 0·45 | 1·73 | 1·73 | 0·86 | .. | .. | .. | .. | .. | .. |
| ,, | 36 | 38 | 1 | 2 | ,, | 2·10 | 2·10 | 2·10 | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| ,, | 50 | 38 | 6 | 12 | ,, | 4 Wells. 14·00 | 2·33 | 2·33 | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| ,, | 40 | 37 | 1 | 2 | ,, | 1·30 | 1·30 | 1·30 | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| ,, | 26 | 36 | 2 | 4 | ,, | 4·56 | 2·28 | 2·28 | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| ,, | 38 | 36 | 1 | 2 | ,, | 3·50 | 3·50 | 3·50 | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| ,, | 24 | 35 | 1 | 4 | ,, | 2·00 | 2·00 | 1·00 | .. | .. | .. | .. | .. | .. | .. | .. | .. |

* These examples are omitted in the calculations for mean areas, &c.

*Provinces and Oudh, and the number of waterings required for each class of irrigated crop*—1881–83.

| Rabi. | | | | | | | | | | | | Kharif. | | | | | Remarks. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Safflower. | Safflower & Gram. | Safflower & Carrots. | Gram. | Carrots. | Peas. | Oats. | Opium. | Tobacco. | Potatoes. | Garlic. | Garden. | Sugar. | Cotton. | Indian Corn. | Millet. | Indigo. | |
| | | | | | | | | 1·70 | 1·70 | | | | | | | | Area. |
| .. | .. | .. | .. | .. | .. | .. | .. | 12 | 12 | .. | .. | .. | .. | .. | .. | .. | Waterings. |
| | | | | | | | | 1·00 | 1·00 | | 1·60 | | | | | | Area. |
| .. | .. | .. | .. | .. | .. | .. | .. | 12 | 12 | .. | 10 | .. | .. | .. | .. | .. | Waterings. |
| | | | | | | | | | | | | | 3·20 | | | | Area. |
| .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 2 | .. | .. | .. | Waterings. |
| | | | | | | | | | | | | | 1·60 | | | | Area. |
| .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 2 | .. | .. | .. | Waterings. |
| | | | | | | | | | | | | | 1·85 | | | | Area. |
| .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 2 | .. | .. | .. | Waterings. |
| | | | | | | | | | | | | | | | | | Area. |
| .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | Waterings. |
| | | | | | | | | | | | | | | | | | Area. |
| .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | Waterings. |
| | | | | | | | 1·32 | | | | | | | | | | Area. |
| .. | .. | .. | .. | .. | .. | .. | 6 | .. | .. | .. | .. | .. | .. | .. | .. | .. | Waterings. |
| | | | | | | | 2·90 | | | | | | | | | | Area. |
| .. | .. | .. | .. | .. | .. | .. | 6 | .. | .. | .. | .. | .. | .. | .. | .. | .. | Waterings. |
| | | | | | | | | | | | | | | | | | Area. |
| .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | Waterings. |
| | | | | | | | | | | | | | | | | | Area. |
| .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | Waterings. |
| | | | | | | | | | | | | | 2·00 | | | | Area. |
| .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 2 | .. | .. | .. | Waterings. |
| | | | | | | | | | | | | | | | | 2·00 | Area. |
| .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 2 | Waterings. |
| | | | | | | | | | | | | | | | | | Area. |
| .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | Waterings. |
| | | | | | | | 7·7 | 4·9 | 4·0 | | 2·9 | | 81·2 | | | 18·8 | Per cent. area. |
| .. | .. | .. | .. | .. | .. | .. | 6 | 12 | 12 | .. | 10 | .. | 2 | .. | .. | 2 | Mean waterings. Area 65·60 |
| | | | | | | | 0·15 | | | | | | | | | | Area. |
| .. | .. | .. | .. | .. | .. | .. | 10 | .. | .. | .. | .. | .. | .. | .. | .. | .. | Waterings. |
| | | | | | | | 0·24 | | | | | | | | | | Area. |
| .. | .. | .. | .. | .. | .. | .. | 10 | .. | .. | .. | .. | .. | .. | .. | .. | .. | Waterings. |
| | | | | | | | 0·32 | | | | | | | | | | Area. |
| .. | .. | .. | .. | .. | .. | .. | 7 | .. | .. | .. | .. | .. | .. | .. | .. | .. | Waterings. |
| | | | | | | | | | | | | 2·27 | | | | | Area. |
| .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 4 | .. | .. | .. | .. | Waterings. |
| | | | | | | | | 9·9 | | | | | | | | | Area. |
| .. | .. | .. | .. | .. | .. | .. | .. | 5 | .. | .. | .. | .. | .. | .. | .. | .. | Waterings. |
| | | | | | | | | 3·4 | | | | | | | | | Area. |
| .. | .. | .. | .. | .. | .. | .. | .. | 5 | .. | .. | .. | .. | .. | .. | .. | .. | Waterings. |
| | | | | | | | | 37·0 | | | | | | | | | Area. |
| .. | .. | .. | .. | .. | .. | .. | .. | 7 | .. | .. | .. | .. | .. | .. | .. | .. | Waterings. |
| | | | | | | | | | | | 0·9 | 1·73 | | | | | Area. |
| .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 10 | 4 | .. | .. | .. | .. | Waterings. |
| | | | | | | | 2·1 | | | | | | | | | | Area. |
| .. | .. | .. | .. | .. | .. | .. | 10 | .. | .. | .. | .. | .. | .. | .. | .. | .. | Waterings. |
| | | | | | | | | 14·0 | | | | | | | | | Area. |
| .. | .. | .. | .. | .. | .. | .. | .. | 7 | .. | .. | .. | .. | .. | .. | .. | .. | Waterings. |
| | | | | | | | | | | | 1·3 | | | | | | Area. |
| .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 10 | .. | .. | .. | .. | .. | Waterings. |
| | | | | | | | 4·56 | | | | | | | | | | Area. |
| .. | .. | .. | .. | .. | .. | .. | 5 | .. | .. | .. | .. | .. | .. | .. | .. | .. | Waterings. |
| | | | | | | | | 3·50 | | | | | | | | | Area. |
| .. | .. | .. | .. | .. | .. | .. | .. | 10 | .. | .. | .. | .. | .. | .. | .. | .. | Waterings. |
| | | | | | | | 2·0 | | | | | | | | | | Area. |
| .. | .. | .. | .. | .. | .. | .. | 5 | .. | .. | .. | .. | .. | .. | .. | .. | .. | Waterings. |

TABLE B—*Showing the Yearly Area in Acres commanded by Wells in 20 Districts of the North-Western*

| District. | Number. | Depth to water surface, | No. of lifts. | No. of cattle or men lifting. | Class. | RABI. Duty per Well. | RABI. Duty per Lift. | RABI. Duty per Pair. | KHARIF. Duty per Well. | KHARIF. Duty per Lift. | KHARIF. Duty per Pair. | RABI. Wheat. | RABI. Wheat & Barley. | RABI. Wheat & Gram. | RABI. Barley. | RABI. Barley & Gram. | RABI. Barley & Peas. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Hamirpur—(*Contd.*) | 32 | 27 | 2 | 4 | Lagor, | 4·00 | 2·00 | 2·00 | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| ,, | 31 | 22 | 1 | 4 | ,, | 2·83 | 2·83 | 1·41 | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| ,, | 29 | 22 | 1 | 2 | ,, | 2·60 | 2·60 | 2·60 | 2·60 | 2·60 | 2·60 | .. | .. | .. | .. | .. | .. |
| ,, | 27 | 21 | 1 | 2 | ,, | *0·90 | 0·90 | 0·90 | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| ,, | 35 | 19 | 1 | 2 | ,, | 4·70 | 4·70 | 4·70 | .. | .. | .. | .. | .. | .. | 4·7 | .. | .. |
| ,, | 48 | 18 | 2 | 4 | ,, | .. | .. | .. | 3·00 | 1·50 | 1·50 | .. | .. | .. | 6 | .. | .. |
| ,, | 49 | 18 | 2 | 8 | ,, | .. | .. | .. | 1·75 | 0·82 | 0·41 | .. | .. | .. | .. | .. | .. |
| ,, | 42 | 16 | 2 | 4 | ,, | 2·60 | 1·30 | 1·30 | .. | .. | .. | .. | .. | .. | 2·6 | .. | .. |
| ,, | 41 | 14 | 2 | 4 | ,, | 3·40 | 1·70 | 1·70 | 1·80 | 0·90 | 0·90 | .. | .. | .. | 6 | .. | .. |
| ,, | 43 | 14 | 2 | 4 | ,, | 3·60 | 1·80 | 1·80 | .. | .. | .. | .. | 3·6 | .. | 3·4 | .. | .. |
| ,, | 34 | 12 | 1 | 2 | ,, | 2·00 | 2·00 | 2·00 | .. | .. | .. | .. | 3 | .. | 5 | .. | .. |
| Mean, .. | Kharif, 28 | .. | 4 | } | ,, | 4·32 | 2·61 | 2·50 | 2·19 | 1·64 | 1·42 | .. | 3·4 | .. | 12·0 | .. | .. |
| | Rabi, 33 | .. | 3 | | | | | | | | | | 3 | | 6 | | |
| Farukhabad, .. | 67 | 66 | 7 | 14 | ,, | 6 Wells 35·90 | 5·13 | 5·13 | .. | .. | .. | 5·60 2 | .. | .. | 30·30 1 | .. | .. |
| ,, | 63 | 58 | 2 | 4 | ,, | 8·50 | 4·25 | 4·25 | .. | .. | .. | 1·23 3 | .. | .. | 7·23 2 | .. | .. |
| ,, | 90 | 58 | 1 | 2 | ,, | 3·26 | 3·26 | 3·26 | 1·63 | 1·63 | 1·63 | .. | .. | .. | .. | .. | .. |
| ,, | 66 | 57 | 1 | 2 | ,, | 2·11 | 2·11 | 2·11 | .. | .. | .. | .. | 2·11 3 | .. | .. | .. | .. |
| ,, | 88 | 56 | 1 | 2 | ,, | 3·46 | 3·46 | 3·46 | 1·73 | 1·73 | 1·73 | .. | .. | .. | .. | .. | .. |
| ,, | 72 | 47 | 1 | 2 | ,, | 3·92 | 3·92 | 3·92 | .. | .. | .. | .. | .. | .. | 2·66 2 | .. | .. |
| ,, | 69 | 46 | 2 | 5 | ,, | 2 Wells 7·73 | 3·86 | 3·09 | .. | .. | .. | 4·26 3 | .. | .. | 1·43 2 | .. | .. |
| ,, | 92 | 36 | 1 | 2 | ,, | 2·58 | 2·58 | 2·58 | 1·29 | 1·29 | 1·29 | .. | .. | .. | .. | .. | .. |
| ,, | 74 | 35 | 1 | 2 | ,, | 3·15 | 3·15 | 3·15 | .. | .. | .. | 0·66 4 | 0·86 3 | .. | 1·26 2 | .. | .. |
| ,, | 84 | 35 | 1 | 2 | ,, | 1·20 | 1·20 | 1·20 | .. | .. | .. | 0·90 4 | .. | .. | .. | .. | .. |
| ,, | 94 | 35 | 1 | 2 | ,, | 2·34 | 2·34 | 2·34 | 1·17 | 1·17 | 1·17 | .. | .. | .. | .. | .. | .. |
| ,, | 78 | 32 | 1 | 2 | ,, | 2·69 | 2·69 | 2·69 | .. | .. | .. | 1·09 4 | 1·60 3 | .. | .. | .. | .. |
| ,, | 80 | 32 | 1 | 2 | ,, | 3·07 | 3·07 | 3·07 | .. | .. | .. | 1·26 4 | 0·57 3 | .. | 0·94 2 | .. | .. |
| ,, | 87 | 16 | 1 | 1 | Dhenkli, | 0·60 | 0·60 | 1·20 | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| ,, | 86 | 15 | 1 | 1 | ,, | 0·60 | 0·60 | 1·20 | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Mean, .. | Lagor, K. 46 R. 51 | .. | 2 | 2 | Lagor, | 4·21 | 3·15 | 3·10 | 1·45 | 1·45 | 1·45 | 18·7 4 | 6·4 3 | .. | 53·7 2 | .. | .. |
| ,, | Dhenkli, 16 | .. | 1 | 1 | Dhenkli, | 0·60 | 0·60 | 1·20 | .. | .. | .. | .. | .. | .. | .. | .. | .. |

* These examples are omitted in the calculations for mean areas, &c.

*Provinces and Oudh, and the number of waterings required for each class of irrigated crop*—1881-83—(Continued).

| Rabi. | | | | | | | | | | | | Kharif. | | | | | Remarks. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Safflower. | Safflower & Gram. | Safflower & Carrots. | Gram. | Carrots. | Peas. | Oats. | Opium. | Tobacco. | Potatoes. | Garlic. | Garden. | Sugar. | Cotton. | Indian Corn. | Millet. | Indigo. | |
| | | | | | | | | 4·00 | | | | | | | | | Area. |
| .. | .. | .. | .. | .. | .. | .. | .. | 10 | .. | .. | .. | .. | .. | .. | .. | .. | Waterings. |
| | | | | | | | | 2·83 | | | | | | | | | Area. |
| .. | .. | .. | .. | .. | .. | .. | .. | 7 | .. | .. | .. | .. | .. | .. | .. | .. | Waterings. |
| | | | | | | | | | | | 2 6 | | 2·60 | | | | Area. |
| .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 10 | .. | 2 | .. | .. | .. | Waterings. |
| | | | | | | | | | | | 0·9 | | | | | | Area. |
| .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 10 | .. | .. | .. | .. | .. | Waterings. |
| | | | | | | | | | | | | | | | | | Area. |
| .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | Waterings. |
| | | | | | | | | | | | | 3·00 | | | | | Area. |
| .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 7 | .. | .. | .. | .. | Waterings. |
| | | | | | | | | | | | | 1·75 | | | | | Area. |
| .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 8 | .. | .. | .. | .. | Waterings. |
| | | | | | | | | | | | | | | | | | Area. |
| .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | Waterings. |
| | | | | | | | | | | | | 1·8 | | | | | Area. |
| .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 8 | .. | .. | .. | .. | Waterings. |
| | | | | | | | | | | | | | | | | | Area. |
| .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | Waterings. |
| | | | | | | | | | | | | | | | | | Area. |
| .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | Waterings. |
| | | | | | | | 8·8 | 70·5 | | | 5·3 | 80·2 | 19·8 | | | | Per cent. area. |
| .. | .. | .. | .. | .. | .. | .. | 8 | 6 | .. | .. | 10 | 6 | 2 | .. | .. | .. | Mean waterings. Area 119·15 |
| | | | | | | | | | | | | | | | | | Area. |
| .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | Waterings. |
| | | | | | | | 0·40 | | | | | | | | | | Area. |
| .. | .. | .. | .. | .. | .. | .. | 6 | .. | .. | .. | .. | .. | .. | .. | .. | .. | Waterings. |
| | | | | | | | | 1·63 | 1·63 | | | | | 1·63 | | | Area. |
| .. | .. | .. | .. | .. | .. | .. | .. | 10 | 10 | .. | .. | .. | .. | 2 | .. | .. | Waterings. |
| | | | | | | | | | | | | | | | | | Area. |
| .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | Waterings. |
| | | | | | | | | 1·73 | 1·73 | | | | | 1·50 | 0·23 | | Area. |
| .. | .. | .. | .. | .. | .. | .. | .. | 12 | 12 | .. | .. | .. | .. | 2 | 2 | .. | Waterings. |
| | | | | | | | 1·26 | | | | | | | | | | Area. |
| .. | .. | .. | .. | .. | .. | .. | 7 | .. | .. | .. | .. | .. | .. | .. | .. | .. | Waterings. |
| | | | | | | | 2·06 | | | | | | | | | | Area. |
| .. | .. | .. | .. | .. | .. | .. | 6 | .. | .. | .. | .. | .. | .. | .. | .. | .. | Waterings. |
| | | | | | | | | 1·29 | 1·29 | | | | | | 1·29 | | Area. |
| .. | .. | .. | .. | .. | .. | .. | .. | 10 | 10 | .. | .. | .. | .. | .. | 4 | .. | Waterings. |
| | | | | | | | 0·37 | | | | | | | | | | Area. |
| .. | .. | .. | .. | .. | .. | .. | 12 | .. | .. | .. | .. | .. | .. | .. | .. | .. | Waterings. |
| | | | | | | | 0·30 | | | | | | | | | | Area. |
| .. | .. | .. | .. | .. | .. | .. | 12 | .. | .. | .. | .. | .. | .. | .. | .. | .. | Waterings. |
| | | | | | | | | 1·17 | 1·17 | | | | | 1·17 | | | Area. |
| .. | .. | .. | .. | .. | .. | .. | .. | 10 | 10 | .. | .. | .. | .. | 2 | .. | .. | Waterings. |
| | | | | | | | | | | | | | | | | | Area. |
| .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | Waterings. |
| | | | | | | | 0·30 | | | | | | | | | | Area. |
| .. | .. | .. | .. | .. | .. | .. | 12 | .. | .. | .. | .. | .. | .. | .. | .. | .. | Waterings. |
| | | | | | | | | | | | 0·60 | | | | | | Area. |
| .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 12 | .. | .. | .. | .. | .. | Waterings. |
| | | | | | | | | | | | 0·60 | | | | | | Area. |
| .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 12 | .. | .. | .. | .. | .. | Waterings. |
| | | | | | | | 5·8 | 7·2 | 7·2 | | 1·0 | | | 73·8 | 26·2 | | Per cent. area. |
| .. | .. | .. | .. | .. | .. | .. | 8 | 10 | 10 | .. | 12 | .. | .. | 2 | 3 | .. | Mean waterings. Area 86·11 |
| | | | | | | | | | | | | | | | | | Area. |
| .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | Waterings. |

TABLE B—*Showing the Yearly Area in Acres commanded by Wells in 20 Districts of the North-Western*

| District. | Number. | Depth to water surface. | No. of lifts. | No. of cattle or men lifting. | Class. | RABI. Duty per Well. | RABI. Duty per Lift. | RABI. Duty per Pair. | KHARIF. Duty per Well. | KHARIF. Duty per Lift. | KHARIF. Duty per Pair. | RABI. Wheat. | RABI. Wheat & Barley. | RABI. Wheat & Gram. | RABI. Barley. | RABI. Barley & Gram. | RABI. Barley & Peas. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Mainpuri, .. | 147 | 25 | 1 | 2 | Lagor, | 3·25 | 3·25 | 3·25 | .. | .. | .. | 1·14 | 1·74 | | 0·37 | | |
| | | | | | | | | | | | | 4 | 3 | .. | 2 | .. | .. |
| | | | | | | | | | | | | 4·57 | | | 5·77 | | |
| „ | 150 | 24 | 1 | 6 | Kili, | 10·74 | 10·74 | 3·58 | .. | .. | .. | 3 | .. | .. | 2 | .. | .. |
| | | | | | | | | | | | | 12·08 | | | 6·63 | | |
| „ | 153 | 23 | 2 | 9 | „ | 18·71 | 9·36 | 4·15 | .. | .. | .. | 3 | .. | .. | 2 | .. | .. |
| | | | | | | | | | | | | | 5·65 | 3·20 | | 3·86 | |
| „ | 100 | 21 | 4 | 8 | Lagor, | 13·71 | 3·43 | 3·43 | .. | .. | .. | .. | 3 | 3 | .. | 2 | .. |
| | | | | | | | | | | | | 4·70 | 1·97 | | 5·40 | | |
| „ | 123 | 21 | 2 | 6 | „ | 13·24 | 6·62 | 4·14 | 1·80 | 0·90 | 0·60 | 3 | 3 | .. | 2 | .. | .. |
| | | | | | | | | | | | | 3·17 | | | 1·90 | | |
| „ | 143 | 21 | 2 | 4 | „ | 7·07 | 3·03 | 3·03 | .. | .. | .. | 3 | .. | .. | 2 | .. | .. |
| | | | | | | | | | | | | 9·90 | 2·10 | | 4·90 | | |
| „ | 110 | 20 | 4 | 16 | „ | 16·90 | 4·23 | 2·11 | .. | .. | .. | 3 | 3 | .. | 3 | .. | .. |
| | | | | | | | | | | | | 1·40 | 3·83 | | 1·23 | | |
| „ | 96 | 19 | 2 | 4 | „ | 6·46 | 3·23 | 3·23 | .. | .. | .. | 3 | 2 | .. | 2 | .. | .. |
| | | | | | | | | | | | | 11·43 | 3·11 | | 3·23 | | |
| „ | 117 | 19 | 4 | 9 | „ | 17·77 | 4·44 | 3·95 | 2·80 | 0·70 | 0·60 | 3 | 3 | .. | 2 | .. | .. |
| | | | | | | | | | | | | 2·25 | 1·23 | | 2·51 | | |
| „ | 120 | 19 | 2 | 4 | „ | 5·99 | 3·00 | 3·00 | 3·17 | 1·58 | 1·58 | 3 | 3 | .. | 2 | .. | .. |
| | | | | | | | | | | | | 4·40 | | | | | |
| „ | 140 | 18 | 1 | 2 | „ | 4·40 | 4·40 | 4·40 | .. | .. | .. | 3 | .. | .. | .. | .. | .. |
| | | | | | | | | | | | | 2·63 | 0·45 | | 7·70 | | |
| „ | 173 | 18 | 4 | 8 | „ | 12·35 | 3·09 | 3·09 | .. | .. | .. | 3 | 3 | .. | 2 | .. | .. |
| | | | | | | | | | | | | 3·14 | 13·00 | | | | |
| „ | 113 | 17 | 3 | 6 | „ | 16·51 | 5·50 | 5·50 | .. | .. | .. | 3 | 3 | .. | .. | .. | .. |
| | | | | | | | | | | | | 10·29 | 3·11 | | 2·77 | | |
| „ | 128 | 17 | 4 | 8 | „ | 16·17 | 4·04 | 4·04 | .. | .. | .. | 3 | 3 | .. | 2 | .. | .. |
| | | | | | | | | | | | | 5·31 | | | | | |
| „ | 138 | 17 | 1 | 2 | „ | 5·46 | 5·46 | 5·46 | .. | .. | .. | 3 | .. | .. | .. | .. | .. |
| | | | | | | | | | | | | 4·10 | | | | | |
| „ | 141 | 17 | 1 | 2 | „ | 4·10 | 4·10 | 4·10 | .. | .. | .. | 3 | .. | .. | .. | .. | .. |
| | | | | | | | | | | | | 1·20 | | | | | |
| „ | 99 | 15 | 1 | 2 | „ | *1·20 | 1·20 | 1·20 | .. | .. | .. | 3 | .. | .. | .. | .. | .. |
| | | | | | | | | | | | | 2·46 | 2·77 | | 2·97 | | |
| „ | 106 | 15 | 4 | 8 | „ | 10·10 | 2·52 | 2·52 | .. | .. | .. | 3 | 3 | .. | 2 | .. | .. |
| | | | | | | | | | | | | 2·98 | | | 1·12 | | |
| „ | 136 | 15 | 1 | 2 | „ | 4·10 | 4·10 | 4·10 | .. | .. | .. | 3 | .. | .. | 2 | .. | .. |
| | | | | | | | | | | | | 4·46 | | | | | |
| „ | 131 | 14 | 1 | 2 | „ | 5·37 | 5·37 | 5·37 | .. | .. | .. | 3 | .. | .. | .. | .. | .. |
| | | | | | | | | | | | | 8·14 | 2·03 | 5·30 | 1·18 | | |
| „ | 155 | 13 | 4 | 8 | „ | 19·51 | 4·88 | 4·88 | .. | .. | .. | 4 | 4 | 3 | 3 | .. | .. |
| | | | | | | | | | | | | 6·23 | 1·68 | 3·47 | 11·14 | | |
| „ | 160 | 13 | 6 | 13 | „ | 26·88 (2 Wells.) | 4·48 | 4·10 | 1·46 | 0·25 | 0·24 | 4 | 4 | 3 | 3 | .. | .. |
| | | | | | | | | | | | | 20·30 | 3·50 | 1·37 | 3·66 | | |
| „ | 166 | 12 | 8 | 18 | „ | 28·83 | 3·60 | 3·20 | .. | .. | .. | 4 | 4 | †10 | 3 | .. | .. |
| | | | | | | | | | | | | 6·00 | | | 3·30 | | |
| „ | 170 | 12 | 2 | 4 | „ | 9·84 | 4·92 | 4·92 | .. | .. | .. | 4 | .. | .. | 3 | .. | .. |
| | | | | | | | | | | | | 1·86 | | | 1·50 | | |
| „ | 133 | 10 | 1 | 2 | „ | 3·82 | 3·82 | 3·82 | .. | .. | .. | 3 | .. | .. | 2 | .. | .. |
| Mean, .. | Kharif, | 18 | .. | 8 | | | | | | | | | | | | | |
| | Rabi, | 17 | .. | 6 | Kili, | 11·58 | 4·77 | 3·94 | 2·31 | 0·85 | 0·75 | 47·5 | 16·4 | 4·7 | 23·8 | 1·4 | .. |
| | | 24 | .. | 5 | Lagor, | 10·98 | 6·30 | 3·70 | .. | .. | .. | 3 | 3 | 3 | 2 | 2 | .. |
| .. | 188 | 20 | 3 | 8 | Kili, Lagor, | 8·95 | 2·98 | 2·24 | .. | .. | .. | 7·63 | | | 1·32 | | |
| | | | | | | | | | | | | 4 | .. | .. | 3 | .. | .. |
| | | | | | | | | | | | | 1·70 | | | 4·13 | | |
| | 196 | 20 | 2 | 4 | Kili, | 6·07 | 3·03 | 3·03 | .. | .. | .. | 4 | .. | .. | 3 | .. | .. |

* These examples are omitted in the calculations for mean areas, &c.
† Special crop.

*Provinces and Oudh, and the number of waterings required for each class of irrigated crop*—1881-83—(Continued).

| Rabi. | | | | | | | | | | | | Khabif. | | | | | Remarks. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Safflower. | Safflower & Gram. | Safflower & Carrots. | Gram. | Carrots. | Peas. | Oats. | Opium. | Tobacco. | Potatoes. | Garlic. | Garden. | Sugar. | Cotton. | Indian Corn. | Millet. | Indigo. | |
| .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | Area. |
| | | | | 0·40 | | | | | | | | | | | | | Waterings. |
| .. | .. | .. | .. | 10 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | Area. |
| | | | | | | | | | | | | | | | | | Waterings. |
| .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | Area. |
| | | | | | | | 0·40 | 0·20 | | | 0·40 | | | | | | Waterings. |
| .. | .. | .. | .. | .. | .. | .. | 10 | 10 | .. | .. | 10 | .. | .. | .. | .. | .. | Area. |
| | | | 0·40 | 0·77 | | | | | | | | 1·80 | | | | | Waterings. |
| .. | .. | .. | 2 | 10 | .. | .. | .. | .. | .. | .. | .. | 4 | .. | .. | .. | .. | Area. |
| | | | | 0·70 | | | | | 1·30 | | | | | | | | Waterings. |
| .. | .. | .. | .. | 10 | .. | .. | .. | .. | 10 | .. | .. | .. | .. | .. | .. | .. | Area. |
| | | | | | | | | | | | | | | | | | Waterings. |
| .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | Area. |
| | | | | | | | | | | | | | | | | | Waterings. |
| .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | Area. |
| | | | | | | | | | | | | 2·80 | | | | | Waterings. |
| .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 4 | .. | .. | .. | .. | Area. |
| | | | | | | | | | | | | 3·17 | | | | | Waterings. |
| .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 4 | .. | .. | .. | .. | Area. |
| | | | | | | | | | | | | | | | | | Waterings. |
| .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | Area. |
| | | | | | | | | | | | 1·40 | | | | | | Waterings. |
| .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 10 | .. | .. | .. | .. | .. | Area. |
| | | | | | | | | | | | 0·37 | | | | | | Waterings. |
| .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 10 | .. | .. | .. | .. | .. | Area. |
| | | | | | | | | | | | | | | | | | Waterings. |
| .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 10 | .. | .. | .. | .. | .. | Area. |
| | | | | | | | | | | | | | | | | | Waterings. |
| .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 0·15 | .. | .. | .. | .. | .. | Area. |
| | | | | | | | | | | | | | | | | | Waterings. |
| .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 10 | .. | .. | .. | .. | .. | Area. |
| | | | | | | | | | | | | | | | | | Waterings. |
| .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | Area. |
| | | | | | | | | | | | 1·90 | | | | | | Waterings. |
| .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 10 | .. | .. | .. | .. | .. | Area. |
| | | | | | | | | | | | | | | | | | Waterings. |
| .. | .. | .. | .. | .. | .. | .. | .. | 0·91 | .. | .. | .. | .. | .. | .. | .. | .. | Area. |
| | | | | | | | | 12 | | | | | | | | | Waterings. |
| .. | .. | .. | .. | .. | .. | .. | .. | | .. | .. | .. | .. | .. | .. | .. | .. | Area. |
| | | | 2·86 | | | | | | | | | | | | | | Waterings. |
| .. | .. | .. | 1 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | Area. |
| | | | 2·50 | | | | 1·86 | | | | | 1·46 | | | | | Waterings. |
| .. | .. | .. | 1 | .. | .. | .. | 10 | .. | .. | .. | .. | 4 | .. | .. | .. | .. | Area. |
| | | | | | | | | | | | | | | | | | Waterings. |
| .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | Area. |
| | | | | 0·54 | | | | | | | | | | | | | Waterings. |
| .. | .. | .. | .. | 10 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | Area. |
| | | | | | | | 0·46 | | | | | | | | | | Waterings. |
| .. | .. | .. | .. | .. | .. | .. | 10 | .. | .. | .. | .. | .. | .. | .. | .. | .. | |
| .. | .. | .. | 2·1 | 0·8 | .. | .. | 0·9 | 0·4 | 0·5 | .. | 1·5 | 100·0 | .. | .. | .. | .. | Per cent. area. |
| .. | .. | .. | 1 | 10 | .. | .. | 10 | 11 | 10 | .. | 10 | 4 | .. | .. | .. | .. | Mean waterings. Area 291·83 |
| | | | | | | | | | | | | | | | | | Area. |
| .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | Waterings. |
| | | | | | | 0·24 | | | | | | | | | | | Area. |
| .. | .. | .. | .. | .. | .. | 6 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | Waterings. |

TABLE B—*Showing the Yearly Area in Acres commanded by Wells in 20 Districts of the North-Western*

| District. | Number. | Depth to water surface. | No. of lifts. | No. of cattle or men lifting. | Class. | RABI. Duty per Well. | RABI. Duty per Lift. | RABI. Duty per Pair. | KHARIF. Duty per Well. | KHARIF. Duty per Lift. | KHARIF. Duty per Pair. | RABI. Wheat. | RABI. Wheat & Barley. | RABI. Wheat & Gram. | RABI. Barley. | RABI. Barley & Gram. | RABI. Barley & Peas. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Etah—(*Contd*). ... | 192 | 19 | 2 | 4 | Lagor, | 6·40 | 3·20 | 3·20 | ... | ... | ... | 1·30<br>4 | ... | ... | 4·00<br>3 | ... | ... |
| " | 195 | 18 | 1 | 4 | Kili, | *1·60 | 1·60 | 0·80 | ... | ... | ... | 1·60<br>4 | ... | ... | ... | ... | ... |
| " | 178 | 14 | 3 | 6 | Lagor, | 2 Wells<br>4·70 | 1·57 | 1·57 | 1·70 | 0·57 | ... | 2·70<br>4 | ... | ... | 2·00<br>3 | ... | ... |
| " | 180 | 12 | 2 | 4 | " | 6·86 | 3·43 | 3·43 | ... | ... | ... | 6·00<br>4 | ... | ... | 0·66<br>3 | ... | ... |
| " | 183 | 12 | 2 | 4 | " | 6·90 | 3·45 | 3·45 | ... | ... | ... | 2·30<br>4 | 1·26<br>3 | ... | 1·80<br>2 | ... | ... |
| Mean, ... | ... | 16 | ... | 4 | " | 5·92 | 3·20 | 2·50 | 1·70 | 0·57 | 0·57 | 56·0<br>4 | 3·0<br>3 | ... | 31·5<br>3 | ... | ... |
| Aligarh, ... | 255 | 45 | 2 | 4 | Kili, | 7·98 | 3·99 | 3·99 | ... | ... | ... | 3·52<br>4 | ... | ... | 3·46<br>3 | ... | ... |
| " | 251 | 39 | 1 | 4 | " | 5·62 | 5·62 | 2·81 | ... | ... | ... | 3·63<br>4 | ... | ... | 1·43<br>3 | ... | ... |
| " | 248 | 38 | 1 | 2 | " | 8·80 | 8·80 | 8·80 | ... | ... | ... | 3·90<br>5 | ... | ... | 4 90<br>4 | ... | ... |
| " | 279 | 35 | 1 | 4 | " | 7·40 | 7·40 | 3·70 | ... | ... | ... | 2·23<br>4 | ... | ... | 0·23<br>3 | ... | ... |
| " | 275 | 33 | 2 | 4 | " | 16·73 | 8·36 | 8·36 | ... | ... | ... | 5·20<br>3 | ... | ... | ... | ... | 11·30<br>3 |
| " | 259 | 29 | 7 | 28 | " | 42·16 | 6·02 | 3·01 | ... | ... | ... | 27·20<br>3 | 2·65<br>3 | ... | 1·03<br>2 | ... | 9·94<br>2 |
| " | 242 | 28 | 1 | 4 | " | 6·34 | 6·34 | 3·17 | ... | ... | ... | 2·71<br>5 | ... | ... | ... | ... | ... |
| " | 239 | 27 | 1 | 2 | " | 1·95 | 1·95 | 1·95 | ... | ... | ... | 0·83<br>5 | ... | ... | 1·12<br>4 | ... | ... |
| " | 283 | 27 | 1 | 4 | " | 8·04 | 8·04 | 4·02 | ... | ... | ... | 2·30<br>4 | ... | ... | 2·14<br>8 | ... | 3·60<br>3 |
| " | 268 | 23 | 4 | 8 | " | 22·99 | 5·75 | 5·75 | ... | ... | ... | 9·90<br>3 | 3·40<br>3 | ... | 4·50<br>2 | ... | ... |
| " | 225 | 20 | 3 | *x* | " | 22·86 | 7·27 | ... | ... | ... | ... | 13·57<br>5 | ... | ... | 7·43<br>3 | ... | ... |
| " | 229 | 20 | 2 | 6 | " | 2 Wells<br>17·14 | 8·57 | 5·71 | 3·17 | 1·58 | 1·06 | 7·86<br>5 | ... | ... | 7·17<br>3 | ... | ... |
| " | 234 | 19 | 3 | 6 | " | 14·79 | 4·93 | 4·93 | ... | ... | ... | 7·34<br>5 | ... | ... | 5·03<br>3 | ... | ... |
| " | 207 | 18 | 1 | 6 | " | 9·91 | 9·91 | 3·30 | 3·57 | 3·57 | 1·19 | 3·50<br>4 | ... | ... | 5·54<br>3 | ... | ... |
| " | 221 | 17 | 1 | 4 | " | 16·37 | 16·37 | 8·09 | ... | ... | ... | 11·34<br>3 | ... | ... | 4·91<br>2 | ... | ... |
| " | 211 | 16 | 2 | 6 | " | 9·05 | 4·52 | 3·02 | 2·43 | 1·22 | 0·81 | 2·03<br>4 | 1·71<br>3 | ... | 3·83<br>3 | ... | ... |
| " | 217 | 16 | 2 | 12 | " | 22·45 | 11·22 | 3·74 | ... | ... | ... | 10·90<br>3 | ... | ... | 8·75<br>2 | ... | ... |
| " | 203 | 14 | 1 | 4 | " | 8·52 | 8·52 | 4·26 | ... | ... | ... | 4·98<br>3 | 1·43<br>2 | ... | ... | ... | ... |
| " | 200 | 11 | 2 | 8 | " | 9·43 | 4·71 | 2·36 | ... | ... | ... | 8·70<br>4 | ... | ... | 0·73<br>3 | ... | ... |
| Mean, ... | Kharif, 18<br>Rabi, 24·7 | ... | 6 | " | 12·92 | 7·28 | 4·50 | 3·02 | 2·12 | 1·02 | 50·3<br>4 to 5 | 3·5<br>3 | ... | 24·0<br>3 | ... | 9·6<br>3 |
| Muttra, ... | 307 | 67 | 2 | 8 | " | 13·52 | 6·76 | 3·38 | ... | ... | ... | 7·81<br>4 | ... | ... | 5·71<br>2 | ... | ... |
| " | 300 | 62 | 2 | 4 | Lagor, | 7·01 | 3·50 | 3·50 | ... | ... | ... | 5·71<br>4 | ... | ... | 0·73<br>3 | ... | ... |

* These examples are omitted in the calculations for mean areas, &c.

*Provinces and Oudh, and the number of waterings required for each class of irrigated crop*—1881-83—(Continued).

| Rabi. | | | | | | | | | | | | Khabif. | | | | | Remarks. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Safflower. | Safflower & Gram. | Safflower & Carrots. | Gram. | Carrots. | Peas. | Oats. | Opium. | Tobacco. | Potatoes. | Garlic. | Garden. | Sugar. | Cotton. | Indian Corn. | Millet. | Indigo. | |
| | | | | 1·10 | | | | | | | | | | | | | Area. |
| ... | ... | ... | ... | 8 | ... | ... | .... | ... | ... | ... | ... | ... | ... | ... | ... | .. | Waterings. |
| | | | | | | | | | | | | | | | | | Area. |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | Waterings. |
| | | | | | | | | | | | | 1·70 | | | | | Area. |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | 3 | ... | ... | ... | ... | Waterings. |
| | | | | | | | 0·20 | | | | | | | | | | Area. |
| ... | ... | ... | ... | ... | ... | ... | 10 | ... | ... | ... | ... | ... | ... | ... | ... | ... | Waterings. |
| | | | | 0·54 | | | 1·00 | | | | | | | | | | Area. |
| ... | ... | ... | ... | 10 | ... | ... | 8 | ... | ... | ... | ... | ... | ... | ... | ... | ... | Waterings. |
| | | | | 4·0 | | 0·5 | 3·0 | | | | | 100·0 | | | | | Per cent. area. |
| ... | ... | ... | ... | 9 | ... | 6 | 9 | ... | ... | ... | ... | 3 | ... | ... | ... | ... | Mean waterings. Area 43·18 |
| | | | | | | | | | | | 1·00 | | | | | | Area. |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | 4 | ... | ... | ... | ... | ... | Waterings. |
| | | 0·66 | | | | | | | | | | | | | | | Area. |
| ... | ... | 4 | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | Waterings. |
| | | | | | | | | | | | | | | | | | Area. |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | Waterings. |
| | | | | 4·94 | | | | | | | | | | | | | Area. |
| ... | ... | ... | ... | 5 | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | Waterings. |
| | 0·23 | | | | | | | | | | | | | | | | Area. |
| ... | 1 | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | Waterings. |
| | | 1·34 | | | | | | | | | | | | | | | Area. |
| ... | ... | 5 | ... | ... | ... | ... | ... | .. | ... | ... | ... | ... | ... | ... | ... | ... | Waterings. |
| | | 0·83 | | | | | | 0·80 | 1·10 | 1·00 | | | | | | | Area. |
| ... | ... | 3 | ... | ... | ... | ... | ... | 6 | 4 | 10 | ... | ... | ... | ... | ... | ... | Waterings. |
| | | | | | | | | | | | | | | | | | Area. |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | Waterings. |
| | | | | | | | | | | | | | | | | | Area. |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | Waterings. |
| | | 1·26 | | | | | | 3·03 | | | 0·90 | | | | | | Area. |
| ... | ... | 5 | ... | ... | ... | ... | ... | 10 | ... | ... | 10 | ... | ... | ... | ... | ... | Waterings. |
| | | | | | 1·86 | | | | | | | | | | | | Area. |
| ... | ... | ... | ... | ... | 2 | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | Waterings. |
| 0·60 | | | | | 1·51 | | | | | | | | 3·17 | | | | Area. |
| 3 | ... | ... | ... | ... | 2 | ... | ... | ... | ... | ... | ... | ... | 2 | ... | ... | ... | Waterings. |
| | | | 1·14 | | | | | 1·28 | | | | | | | | | Area. |
| ... | ... | ... | 1 | ... | ... | ... | ... | 10 | ... | ... | ... | ... | ... | ... | ... | ... | Waterings. |
| | | | | | | | 0·30 | 0·57 | | | | | 3·57 | | | | Area. |
| ... | ... | ... | ... | ... | ... | ... | 10 | 10 | ... | ... | ... | ... | 2 | ... | ... | ... | Waterings. |
| | | | | | | 0·12 | | | | | | | | | | | Area. |
| ... | ... | ... | ... | ... | ... | 6 | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | Waterings. |
| | | | | | | | 0·20 | 1·28 | | | | | 2·43 | | | | Area. |
| ... | ... | ... | ... | ... | ... | ... | 10 | 10 | ... | ... | ... | ... | 2 | ... | ... | ... | Waterings. |
| | | | 2·80 | | | | | | | | | | | | | | Area. |
| ... | ... | ... | 1 | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | Waterings. |
| | | | 2·11 | | | | | | | | | | | | | | Area. |
| ... | ... | ... | 1 | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | Waterings. |
| | | | | | | | | | | | | | | | | | Area. |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | Waterings. |
| 0·4 | 0·1 | 1·6 | 2·0 | 2·0 | 1·4 | 0·05 | 0·2 | 2·7 | 0·6 | 0·55 | 1·00 | | 100·0 | | | | Per cent. area. |
| 3 | 1 | 4 | 1 | 5 | 2 | 6 | 10 | 10 | 4 | 10 | 7 | ... | 2 | ... | ... | ... | Mean waterings. **Area** 267·80 |
| | | | | | | | | | | | | | | | | | Area. |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | Waterings. |
| | | 0·57 | | | | | | | | | | | | | | | Area. |
| ... | ... | 5 | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | Waterings. |

TABLE B—*Showing the Yearly Area in Acres commanded by Wells in 20 Districts of the North-Western*

| District | Number. | Depth to water surface. | No. of lifts. | No. of cattle or men lifting. | Class. | RABI. Duty per Well. | RABI. Duty per Lift. | RABI. Duty per Pair. | KHARIF. Duty per Well. | KHARIF. Duty per Lift. | KHARIF. Duty per Pair. | RABI. Wheat. | RABI. Wheat & Barley. | RABI. Wheat & Gram. | RABI. Barley. | RABI. Barley & Gram. | RABI. Barley & Peas. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Muttra—(*Contd.*),... | 319 | 59 | 2 | 4 | Kili, | 9·17 | 4·58 | 4·58 | ... | ... | ... | 4·72 | | | 2·73 | | 1·06 |
| | | | | | | | | | | | | 5 | ... | ... | 3 | ... | 3 |
| ,, | 325 | 59 | 2 | 4 | ,, | 10·49 | 5·24 | 5·24 | ... | ... | ... | | 0·71 | | 0·32 | | 9·46 |
| | | | | | | | | | | | | ... | 3 | ... | 2 | ... | 2 |
| ,, | 312 | 58 | 1 | 2 | ,, | 4·23 | 4·23 | 4·23 | ... | ... | ... | 4·20 | | | | | |
| | | | | | | | | | | | | 4 | ... | ... | ... | ... | ... |
| ,, | 315 | 58 | 1 | 4 | ,, | *1·75 | 1·75 | 0·87 | ... | ... | ... | 0·63 | 1·10 | | | | |
| | | | | | | | | | | | | 5 | 4 | ... | ... | ... | ... |
| ,, | 287 | 51 | 1 | 2 | ,, | 5·30 | 5·30 | 5·30 | ... | ... | ... | 2·56 | | 1·37 | 1·37 | | |
| | | | | | | | | | | | | 5 | ... | 5 | 4 | ... | ... |
| ,, | 291 | 49 | 1 | 2 | ,, | 6·59 | 6·59 | 6·59 | ... | ... | ... | | | | | 6·59 | |
| | | | | | | | | | | | | ... | ... | ... | ... | 3 | ... |
| ,, | 294 | 48 | 1 | 2 | ,, | 3·24 | 3·24 | 3·24 | ... | ... | ... | 1·70 | | | 1·54 | | |
| | | | | | | | | | | | | 5 | ... | ... | 4 | ... | ... |
| ,, | 296 | 46 | 2 | 4 | ,, | 17·62 | 8·81 | 8·81 | ... | ... | ... | 12·07 | | | 3·00 | | |
| | | | | | | | | | | | | 5 | ... | ... | 4 | ... | ... |
| ,, | 304 | 16 | 1 | 2 | ,, | 5·45 | 5·45 | 5·45 | ... | ... | ... | 1·38 | | | 4·07 | | |
| | | | | | | | | | | | | 3 | ... | ... | 2 | ... | ... |
| Mean, ... | ... | 51 | ... | 3·4 | ,, | 8·40 | 5·58 | 5·20 | ... | ... | ... | 48·3 | 2·15 | 1·6 | 23·0 | 7·8 | 12·6 |
| | | | | | | | | | | | | 5 | 4 | 5 | 3 | 3 | 2 |
| Bulandshahr, ... | 334 | 39 | 1 | 2 | ,, | 3·11 | 3·11 | 3·11 | ... | ... | ... | | 1·347 | | | | |
| | | | | | | | | | | | | ... | 2 | ... | ... | ... | ... |
| ,, | 340 | 34 | 3 | 10 | ,, | 10·44 | 3·45 | 2·09 | 2·10 | 0·70 | 0·42 | 6·17 | | | 0·48 | | |
| | | | | | | | | | | | | 6 | ... | ... | 5 | ... | ... |
| ,, | 329 | 30 | 2 | 8 | ,, | 2 Wells. 13·02 | 6·51 | 3·26 | ... | ... | ... | 3·56 | 3·65 | 2·25 | | | 3·56 |
| | | | | | | | | | | | | 4 | 3 | 3 | ... | ... | 2 |
| ,, | 374 | 30 | 2 | 8 | ,, | 28·62 | 14·31 | 7·15 | ... | ... | ... | | 10·60 | 1·78 | 11·40 | | |
| | | | | | | | | | | | | ... | 4 | 4 | 3 | ... | ... |
| ,, | 359 | 27 | 2 | 8 | ,, | 19·36 | 9·68 | 4·84 | ... | ... | ... | 5·53 | 1·625 | 2·65 | 0·22 | | 1·56 |
| | | | | | | | | | | | | 4 | 4 | 3 | 3 | ... | 3 |
| ,, | 369 | 27 | 1 | 4 | ,, | 3·92 | 3·92 | 1·96 | ... | ... | ... | 2·09 | | | 0·06 | | |
| | | | | | | | | | | | | 4 | ... | ... | 3 | ... | ... |
| ,, | 389 | 26 | 2 | 8 | ,, | 18·54 | 9·27 | 4·63 | ... | ... | ... | 4·81 | | | | | 5·09 |
| | | | | | | | | | | | | 4 | ... | ... | ... | ... | 3 |
| ,, | 346 | 23 | 3 | 6 | ,, | 22·01 | 7·34 | 7·34 | 2·20 | 0·73 | 0·73 | 4·50 | | | 3·84 | | |
| | | | | | | | | | | | | 7 | .. | ... | 4 | ... | ... |
| ,, | 381 | 18 | 1 | 4 | ,, | 6·69 | 6·69 | 3·35 | ... | ... | ... | 2·56 | 2·12 | | | | |
| | | | | | | | | | | | | 4 | 4 | ... | ... | ... | ... |
| ,, | 386 | 16 | 1 | 4 | ,, | 4·35 | 4·35 | 2·18 | ... | ... | ... | 0·88 | | | | | |
| | | | | | | | | | | | | 4 | ... | ... | ... | ... | ... |
| ,, | 400 | 16 | 1 | 4 | ,, | 8·11 | 8·11 | 4·05 | 1·12 | 1·12 | 0·51 | 4·12 | | 0·96 | 0·13 | | 2·70 |
| | | | | | | | | | | | | 4 | ... | 4 | 3 | ... | 3 |
| ,, | 394 | 15 | 1 | 4 | ,, | 11·85 | 11·85 | 5·93 | ... | ... | ... | 5·38 | 0·88 | | 1·57 | | 3·36 |
| | | | | | | | | | | | | 4 | 4 | ... | 3 | ... | 3 |
| ,, | 353 | 14 | 1 | 4 | ,, | 9·02 | 9·02 | 4·51 | ... | ... | ... | | 0·65 | | 2·30 | | 3·47 |
| | | | | | | | | | | | | ... | 4 | .. | 3 | ... | 3 |
| Mean, ... | Kharif, 24 Rabi, 24 | ... | 5·7 | ,, | 11·36 | 7·50 | 4·18 | 1·81 | 0·85 | 0·55 | 24·6 | 13·1 | 4·6 | 12·9 | | 12·8 |
| | | | | | | | | | | | | 4 | 4 | 3 | 3 | ... | 3 |
| Meerut, ... | 434 | 27 | 2 | 8 | ,, | 11·20 | 5·60 | 2·80 | ... | ... | ... | 7·22 | | | | | |
| | | | | | | | | | | | | 3 | ... | ... | ... | ... | ... |
| ,, | 410 | 25 | 4 | 16 | ,, | 3 Wells. 23·27 | 5·82 | 2·91 | 2·60 | 0·65 | 0·33 | 15·00 | 3·80 | | | | 1·12 |
| | | | | | | | | | | | | 4 | 3 | ... | ... | ... | 3 |
| ,, | 430 | 25 | 3 | 12 | ,, | 26·05 | 8·68 | 4·34 | ... | ... | ... | 14·43 | | 9·00 | 2·62 | | |
| | | | | | | | | | | | | 4 | ... | 4 | 3 | ... | ... |
| ,, | 425 | 24 | 2 | 8 | ,, | 18·03 | 9·01 | 4·51 | 9·75 | 4·87 | 2·44 | 9·25 | | | | | 7·20 |
| | | | | | | | | | | | | 4 | ... | ... | ... | ... | 3 |

* These examples are omitted in the calculations for mean areas, &c.

*Provinces and Oudh, and the number of waterings required for each class of irrigated crop*—1881–83—(Continued).

| Rabi. | | | | | | | | | | | | Kharif. | | | | | Remarks. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Safflower. | Safflower & Gram. | Safflower & Carrots. | Gram. | Carrots. | Peas. | Oats. | Opium. | Tobacco. | Potatoes. | Garlic. | Garden. | Sugar. | Cotton. | Indian Corn. | Millet. | Indigo. | |
| | | 0·64 | | | | | | | | | 0·02 | | | | | | Area. |
| ... | ... | 6 | ... | ... | ... | ... | ... | ... | ... | ... | 10 | ... | ... | ... | ... | ... | Waterings. |
| | | | | | | | | | | | | | | | | | Area. |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | Waterings. |
| | | | | | | | | | | | 0·03 | | | | | | Area. |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | 10 | ... | ... | ... | ... | ... | Waterings. |
| | | | | | | | | | | | 0·02 | | | | | | Area. |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | 10 | ... | ... | ... | ... | ... | Waterings. |
| | | | | | | | | | | | | | | | | | Area. |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | Waterings. |
| | | | | | | | | | | | | | | | | | Area. |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | Waterings. |
| | | | | | | | | | | | | | | | | | Area. |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | Waterings. |
| | | 2·55 | | | | | | | | | | | | | | | Area. |
| ... | ... | 5 | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | Waterings. |
| | | | | | | | | | | | | | | | | | Area. |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | Waterings. |
| | | 4·5 | | | | | | | | | 0·05 | | | | | | Per cent. area. |
| ... | ... | 5 | ... | ... | ... | ... | ... | ... | ... | ... | 10 | ... | ... | ... | ... | ... | Mean waterings. Area 84·37 |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | 0·63 | | | 1·13 | | | | | | Area. |
| ... | ... | ... | ... | ... | ... | ... | ... | 4 | ... | ... | 7 | ... | ... | ... | ... | ... | Waterings. |
| | | | | | | 0·42 | | | | | 3·37 | 0·79 | 1·31 | | | | Area. |
| ... | ... | ... | ... | ... | ... | 6 | ... | ... | ... | ... | 10 | 4 | 1 | ... | ... | ... | Waterings. |
| | | | | | | | | | | | | | | | | | Area. |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | Waterings. |
| | | | 1·34 | | 0·50 | | | 3·00 | | | | | | | | | Area. |
| ... | ... | ... | 2 | ... | 2 | ... | ... | 8 | ... | ... | ... | ... | ... | ... | ... | ... | Waterings. |
| | | | 2·56 | | 0·56 | | | 3·00 | | | 1·65 | | | | | | Area. |
| ... | ... | ... | 2 | ... | 2 | ... | ... | 8 | ... | ... | 7 | ... | ... | ... | ... | ... | Waterings. |
| | | | | | | | | 1·15 | | | 0·62 | | | | | | Area. |
| ... | ... | ... | ... | ... | ... | ... | ... | 8 | ... | ... | 7 | ... | ... | ... | ... | ... | Waterings. |
| 5·61 | | | | | | | | | | | 3·03 | | | | | | Area. |
| 3 | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | 7 | ... | ... | ... | ... | ... | Waterings. |
| 12·00 | | | | | | 0·07 | | 1·13 | | | 0·47 | | 2·20 | | | | Area. |
| 3 | ... | ... | ... | ... | ... | 7 | ... | 15 | ... | ... | 10 | ... | 3 | ... | ... | ... | Waterings. |
| | | | | | 1·70 | | | | | | 0·31 | | | | | | Area. |
| ... | ... | ... | ... | ... | 2 | ... | ... | ... | ... | ... | 7 | ... | ... | ... | ... | ... | Waterings. |
| | | | | | | | | | | | 3·47 | | | | | | Area. |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | 7 | ... | ... | ... | ... | ... | Waterings. |
| | | | | | | | | 0·20 | | | | 2·80 | 1·12 | | | | Area. |
| ... | ... | ... | ... | ... | ... | ... | ... | 8 | ... | ... | ... | 4 | 1 | ... | ... | ... | Waterings. |
| | | | | | | | | | | | 0·66 | | | | | | Area. |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | 6 | ... | ... | ... | ... | ... | Waterings. |
| | | | | | | | | 0·72 | | | 1·88 | | | | | | Area. |
| ... | ... | ... | ... | ... | ... | ... | ... | 9 | ... | ... | 7 | ... | ... | ... | ... | ... | Waterings. |
| | | | | | | | | | | | | | | | | | |
| 11·0 | | | 2·3 | | 1·8 | 0·3 | | 6·1 | | | 10·5 | 43·7 | 56·3 | | | | Per cent. area. |
| 3 | ... | ... | 2 | ... | 2 | 6 | ... | 9 | ... | ... | 8 | 4 | 2 | ... | ... | ... | Mean waterings. Area 167·26 |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | 2·70 | | 1·28 | | | | | | Area. |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | 10 | ... | 10 | ... | ... | ... | ... | ... | Waterings. |
| | | 0·20 | | | 1·25 | 1·43 | | 0·13 | | | 0·34 | | 2·60 | | | | Area. |
| ... | ... | 5 | ... | ... | 2 | 4 | ... | 8 | ... | ... | 6 | ... | 1 | ... | ... | ... | Waterings. |
| | | | | | | | | | | | | | | | | | Area. |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | Waterings. |
| | | | 0·70 | | 0·88 | | | | | | | 7·75 | 2·00 | | | | Area. |
| ... | ... | ... | 1 | ... | 3 | ... | ... | ... | ... | ... | ... | 8 | 1 | ... | ... | ... | Waterings. |

TABLE B—*Showing the Yearly Area in Acres commanded by Wells in 20 Districts of the North-Western*

| District. | Number. | Depth to water surface. | No. of lifts. | No. of cattle or men lifting. | Class. | RABI. Duty per Well. | RABI. Duty per Lift. | RABI. Duty per Pair. | KHARIF. Duty per Well. | KHARIF. Duty per Lift. | KHARIF. Duty per Pair. | RABI. Wheat. | RABI. Wheat & Barley. | RABI. Wheat & Gram. | RABI. Barley. | RABI. Barley & Gram. | RABI. Barley & Peas. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Meerut—(*Contd.*),... | 406 | 23 | 1 | 4 | Kili, | 3·89 | 3·89 | 1·95 | ... | ... | ... | 0·66<br>4 | 3·00<br>3 | ... | ... | ... | 0·23<br>2 |
| ,, | 419 | 20 | 2 | 8 | ,, | 14·34 | 7·17 | 3·59 | ... | ... | ... | 11·30<br>4 | ... | ... | 0·47<br>3 | ... | ... |
| ,, | 439 | 19 | 1 | 4 | ,, | 10·42 | 10·42 | 5·21 | ... | ... | ... | 5·20<br>3 | ... | ... | 3·91<br>2 | ... | ... |
| Mean, ... | ... | 24 | ... | 6 | ,, | 11·91 | 7·23 | 3·62 | 6·17 | 2·76 | 1·36 | 58·0<br>4 | 6·3<br>3 | 8·9<br>4 | 6·9<br>3 | ... | 8·0<br>3 |
| Muzaffarnagar, ... | 444 | 15 | 1 | 8 | ,, | ... | ... | ... | 12·40 | 12·40 | 3·10 | ... | ... | ... | ... | ... | ... |
| ,, | 447 | 12 | 1 | 4 | ,, | 3·53 | 3·53 | 1·77 | 3·50 | 3·50 | 1·75 | 3·53<br>4 | ... | ... | ... | ... | ... |
| Mean, ... | Kharif, 13<br>Rabi, 12 | ... | 6<br>4 | ,, | 3·53 | 3·53 | 1·77 | 7·95 | 7·95 | 2·42 | 100·0<br>4 | ... | ... | ... | ... | ... |
| Saharanpur, ... | 451 | 18 | 1 | 4 | Lagor, | 3·40 | 3·40 | 1·70 | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| ,, | 449 | 16 | 1 | 2 | ,, | 2·40 | 2·40 | 2·40 | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| Mean, | ... | 17 | ... | 3 | ,, | 2·90 | 2·90 | 2·05 | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| Bijnor, ... | 461 | 20 | 1 | 1 | Dhenkli, | 1·25 | 1·25 | 2·50 | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| ,, | 463 | 20 | 1 | 1 | ,, | 0·25 | 0·25 | 0·50 | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| ,, | 453 | 17 | 1 | 2 | Kili, | ... | ... | ... | 1·90 | 1·90 | 1·90 | ... | ... | ... | ... | ... | ... |
| ,, | 455 | 16 | 1 | 2 | ,, | ... | ... | ... | 1·28 | 1·28 | 1·28 | ... | ... | ... | ... | ... | ... |
| ,, | 465 | 16 | 2 | 16 | ,, | ... | ... | ... | 2 Wells.<br>8·70 | 4·35 | 1·09 | ... | ... | ... | ... | ... | ... |
| ,, | 469 | 16 | 1 | 8 | ,, | ... | ... | ... | 4·25 | 4·25 | 1·06 | ... | ... | ... | ... | ... | ... |
| ,, | 457 | 15 | 1 | 2 | ,, | ... | ... | ... | 1·34 | 1·34 | 1·34 | ... | ... | ... | ... | ... | ... |
| ,, | 459 | 15 | 1 | 2 | ,, | ... | ... | ... | 1·25 | 1·25 | 1·25 | ... | ... | ... | ... | ... | ... |
| Mean, ... | ... | 16 | ... | 3 | ,, | ... | ... | ... | 2·40 | 2·40 | 1·32 | ... | ... | ... | ... | ... | ... |
| ,, | ... | 20 | 1 | 1 | Dhenkli, | 0·75 | 0·75 | 1·50 | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| Moradabad, .... | 478 | 20 | 1 | 4 | Kili, | 0·94 | 0·94 | 0·47 | 0·94 | 0·94 | 0·47 | ... | ... | ... | ... | ... | ... |
| ,, | 484 | 19 | 2 | 2 | Dhenkli, | ... | ... | ... | 1·00 | 0·50 | 1·00 | ... | ... | ... | ... | ... | ... |
| ,, | 471 | 18 | 2 | 8 | Kili, | 2 Wells<br>13·70 | 6·85 | 3·42 | 1·41 | 0·71 | 0·36 | 13·70<br>1 | ... | ... | ... | ... | .. |

*Provinces and Oudh, and the number of waterings required for each class of irrigated crop*—1881-83—(Continued).

| Rabi. | | | | | | | | | | | | Kharif. | | | | | Remarks. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Safflower. | Safflower & Gram. | Safflower & Carrots. | Gram. | Carrots. | Peas. | Oats. | Opium. | Tobacco. | Potatoes. | Garlic. | Garden. | Sugar. | Cotton. | Indian Corn. | Millet. | Indigo. | |
| | | | | | | | | | | | | | | | | | Area. |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | Waterings. |
| | | | | 0·34 | | 0·23 | | | | | 2·00 | | | | | | Area. |
| ... | ... | ... | ... | 6 | ... | 4 | ... | ... | ... | ... | 6 | ... | ... | ... | ... | ... | Waterings. |
| | | | | | | | | | 1·31 | | | | | | | | Area. |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | 10 | ... | ... | ... | ... | ... | ... | ... | Waterings. |
| | | 0·2 | 0·6 | 0·3 | 2·0 | 1·6 | | 0·1 | 3·7 | | 3·4 | 62·8 | 37·2 | | | | Per cent. area. |
| ... | ... | 5 | 1 | 6 | 2 | 4 | ... | 8 | 10 | ... | 7 | 8 | 1 | ... | ... | ... | Mean waterings. Area 119·55 |
| | | | | | | | | | | | | 12·4 | | | | | Area. |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | 5 | ... | ... | ... | ... | Waterings. |
| | | | | | | | | | | | | 3·5 | | | | | Area. |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | 5 | ... | ... | ... | ... | Waterings. |
| | | | | | | | | | | | | 100·0 | | | | | Per cent. area. |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | .. | ... | 5 | ... | ... | ... | ... | Mean waterings. Area 19·45 |
| | | | | | | | | | | | 3·40 | | | | | | Area. |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | 10 | ... | ... | ... | ... | ... | Waterings. |
| | | | | | | | | | | | 2·40 | | | | | | Area. |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | 10 | ... | ... | ... | ... | ... | Waterings. |
| | | | | | | | | | | | 100·0 | | | | | | Per cent. area. |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | 10 | ... | ... | ... | ... | ... | Mean waterings. Area 5·80 |
| | | | | | | | | | | | 1·25 | | | | | | Area. |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | 10 | ... | ... | ... | ... | ... | Waterings. |
| | | | | | | | | | | | 0·25 | | | | | | Area. |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | 10 | ... | ... | ... | ... | ... | Waterings. |
| | | | | | | | | | | | | 1·90 | | | | | Area. |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | 3 | ... | ... | ... | ... | Waterings. |
| | | | | | | | | | | | | 1·28 | | | | | Area. |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | 3 | ... | ... | ... | ... | Waterings. |
| | | | | | | | | | | | | 8·70 | | | | | Area. |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | 3 | ... | ... | ... | ... | Waterings. |
| | | | | | | | | | | | | 4·25 | | | | | Area. |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | 3 | ... | ... | ... | ... | Waterings. |
| | | | | | | | | | | | | 1·34 | | | | | Area. |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | 3 | ... | ... | ... | ... | Waterings. |
| | | | | | | | | | | | | 1·25 | | | | | Area. |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | 3 | ... | ... | ... | ... | Waterings. |
| | | | | | | | | | | | 100·0 | 100·0 | | | | | Per cent. area. |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | 10 | 3 | ... | ... | ... | ... | Mean watering. Area 20·22 |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | |
| | | | | | | | | 0·94 | | | | | | 0·94 | | | Area. |
| ... | ... | ... | ... | ... | ... | ... | ... | 30 | ... | ... | ... | ... | ... | ... | ... | ... | Waterings. |
| | | | | | | | | | | | | 1·0 | | | | | Area. |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | 4 | ... | ... | ... | ... | Waterings. |
| | | | | | | | | | | | | 1·41 | | | | | Area. |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | 4 | ... | ... | ... | ... | Waterings. |

TABLE B—*Showing the Yearly Area in Acres commanded by Wells in 20 Districts of the North-Western*

| District. | Number. | Depth to water surface. | No. of lifts. | No. of cattle or men lifting. | Class. | RABI. Duty per Well. | RABI. Duty per Lift. | RABI. Duty per Pair. | KHARIF. Duty per Well. | KHARIF. Duty per Lift. | KHARIF. Duty per Pair. | RABI. Wheat. | RABI. Wheat & Barley. | RABI. Wheat & Gram. | RABI. Barley. | RABI. Barley & Gram. | RABI. Barley & Peas. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Moradabad—(*Contd.*) | 476 | 18 | 1 | 2 | Kili, | 1·00 | 1·00 | 1·00 | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| „ | 480 | 10 | 2 | 2 | Dhenkli, | ... | ... | ... | 0·90 | 0·45 | 0·90 | ... | ... | ... | ... | ... | ... |
| Mean, ... | ... | 15 | ... | 2 | „ | ... | ... | ... | 0·95 | 0·47 | 0·95 | 87·5 1 | ... | ... | ... | ... | ... |
| „ | ... | 19 | ... | 4 | Kili, | 3·91 | 2·93 | 1·63 | 1·17 | 0·82 | 0·42 | ... | ... | ... | ... | ... | ... |
| Rampur State, ... | 488 | 21 | 2 | 1 | Ráti, | 0·22 | 0·22 | 0·44 | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| Bareilly, ... | 490 | 38 | 3 | 6 | Kili, | 3 Wells. 9·40 | 3·13 | 3·13 | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| „ | 494 | 38 | 1 | 2 | „ | 2·13 | 2·13 | 2·13 | ... | ... | ... | 0·63 2 | ... | ... | ... | ... | ... |
| „ | 497 | 9 | 2 | 1 | Ráti, | 0·50 | 0·50 | 1·00 | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| Mean, ... | ... | 38 | ... | 2 | Kili, | 2·90 | 2·63 | 2·63 | ... | ... | ... | 5·0 2 | ... | ... | ... | ... | ... |
| Pillibhit, ... | 501 | 15 | 2 | 3 | Dhenkli, | ... | ... | ... | 2·80 | 1·40 | 1·86 | ... | ... | ... | ... | ... | ... |
| Shahjahanpur, ... | 517 | 33 | 1 | 2 | Lagor, | 2·30 | 2·30 | 2·30 | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| „ | 514 | 32 | 1 | 2 | „ | 2·28 | 2·28 | 2·28 | ... | ... | ... | ... | ... | ... | 0·56 2 | ... | ... |
| „ | 505 | 30 | 1 | 6 | Coolie, | 4·50 | 4·50 | 1·50 | 2·44 | 2·44 | 0·81 | 4·50 1 | ... | ... | ... | ... | ... |
| „ | 508 | 25 | 1 | 6 | „ | ... | ... | ... | 7·56 | 7·56 | 2·52 | 13·3 1 | ... | ... | ... | ... | ... |
| „ | 522 | 24 | 2 | 1 | Ráti, | 1·16 | 1·16 | 2·32 | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| „ | 526 | 24 | 4 | 2 | „ | 2·32 | 1·16 | 2·32 | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| „ | 520 | 13 | 1 | 1 | Dhenkli, | 0·63 | 0·63 | 1·26 | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| Mean, ... | ... | 33 | ... | 2 | Lagor, | 2·29 | 2·29 | 2·29 | ... | ... | ... | 67·2 1 | ... | ... | 2·1 2 | ... | ... |
| „ | ... | 37 | ... | 6 | Coolie, | 4·50 | 4·50 | 1·50 | 5·00 | 5·00 | 1·66 | ... | .. | ... | ... | ... | ... |
| ..., ... | 535 | 38 | 1 | 2 | Lagor, | 1·27 | 1·27 | 1·27 | ... | ... | ... | 1·27 4 | ... | ... | ... | ... | ... |
| | 537 | 32 | 2 | 4 | „ | 2·94 | 1·47 | 1·47 | ... | ... | ... | 2·94 4 | ... | ... | ... | ... | ... |
| | 539 | 32 | 1 | 2 | „ | 1·89 | 1·89 | 1·89 | ... | .. | ... | 1·89 4 | ... | ... | ... | ... | ... |
| | 540 | 31 | 1 | 2 | „ | 3·09 | 3·09 | 3·09 | .. | ... | ... | 3·09 4 | ... | ... | ... | ... | ... |
| | 542 | 20 | 1 | 2 | Coolie, | 0·70 | 0·70 | 0·70 | ... | ... | ... | 0·70 3 | ... | ... | ... | ... | ... |

*Provinces and Oudh, and the number of waterings required for each class of irrigated crop*—1881-83—(Continued).

| RABI. | | | | | | | | | | | | KHARIF. | | | | | Remarks. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Safflower. | Safflower & Gram. | Safflower & Carrots. | Gram. | Carrots. | Peas. | Oats. | Opium. | Tobacco. | Potatoes. | Garlic. | Garden. | Sugar. | Cotton. | Indian Corn. | Millet. | Indigo. | |
| | | | | | | | | 1·00 | | | | | | | | | Area. |
| ... | ... | ... | ... | ... | ... | ... | ... | 30 | ... | ... | ... | ... | ... | ... | ... | ... | Waterings. |
| | | | | | | | | | | | | 0·90 | | | | | Area. |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | 4 | ... | ... | ... | ... | Waterings. |
| | | | | | | | | 12·5 | | | | 80·0 | | 20·0 | | | Per cent. area. |
| ... | ... | ... | ... | ... | ... | ... | ... | 30 | ... | ... | ... | 4 | ... | ... | ... | ... | Mean watering. Area 18·95 |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | |
| | | | | | | | | 0·15 | | | 0·07 | | | | | | Area. Area 0·22 |
| ... | ... | ... | ... | ... | ... | ... | ... | 28 | ... | ... | 28 | ... | ... | ... | ... | ... | Watering. Ráti counted as 1 lift. |
| | | | | | | | | 67·0 | | | 33·0 | | | | | | Per cent. area. |
| ... | ... | ... | ... | ... | ... | ... | ... | 28 | ... | ... | 28 | ... | ... | ... | ... | ... | Mean waterings. |
| | | | | | | | | 9·40 | | | | | | | | | Area. |
| ... | ... | ... | ... | ... | ... | ... | ... | 20 | ... | ... | ... | ... | ... | ... | ... | ... | Waterings. |
| | | | | | | | | 1·50 | | | | | | | | | Area. |
| ... | ... | ... | ... | ... | ... | ... | ... | 20 | ... | ... | ... | ... | ... | ... | ... | ... | Waterings. |
| | | | | | | | | | | | 0·50 | | | | | | Area. |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | 10 | ... | ... | ... | ... | ... | Waterings. |
| | | | | | | | | 90·8 | | | 4·2 | | | | | | Per cent. area. |
| ... | ... | ... | ... | ... | ... | ... | ... | 20 | ... | ... | 10 | ... | ... | ... | ... | ... | Mean watering. Area 12·03 |
| | | | | | | | | | | | | 2·80 | | | | | Area. |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | 2 | ... | ... | ... | ... | Waterings. Area 2·80 |
| | | | | | | | | 2·30 | | | | | | | | | Area. |
| ... | ... | ... | ... | ... | ... | ... | ... | 20 | ... | ... | ... | ... | ... | ... | ... | ... | Waterings. |
| | | | | | | | | 1·72 | | | | | | | | | Area. |
| ... | ... | ... | ... | ... | ... | ... | ... | 20 | ... | ... | ... | ... | ... | ... | ... | ... | Waterings. |
| | | | | | | | | | | | | 2·44 | | | | | Area. |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | 2 | ... | ... | ... | ... | Waterings. |
| | | | | | | | | | | | | 7·56 | | | | | Area. |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | 2 | ... | ... | ... | ... | Waterings. |
| | | | | | | | | | | | 1·16 | | | | | | Area. |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | 20 | ... | ... | ... | ... | ... | Waterings. |
| | | | | | | | | | | | 2·32 | | | | | | Area. |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | 20 | ... | ... | ... | ... | ... | Waterings. |
| | | | | | | | | | | | 0·63 | | | | | | Area. |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | 20 | ... | ... | ... | ... | ... | Waterings. |
| | | | | | | | | 15·2 | | | 15·5 | 100·0 | | | | | Per cent. area. |
| ... | ... | ... | ... | ... | ... | ... | ... | 20 | ... | ... | 20 | 2 | ... | ... | ... | ... | Mean waterings. Area 36·35 |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | |
| | | | | | | | | | | | | | | | | | Area. |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | Waterings. |
| | | | | | | | | | | | | | | | | | Area. |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | Waterings. |
| | | | | | | | | | | | | | | | | | Area. |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | Waterings. |
| | | | | | | | | | | | | | | | | | Area. |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | Waterings. |
| | | | | | | | | | | | | | | | | | Area. |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | Waterings. |

TABLE B.—*Showing the Yearly Area in Acres commanded by Wells in* 20 *Districts of the North-Western*

| District. | Number. | Depth to water surface. | No. of lifts. | No. of cattle or men lifting. | Class. | RABI. Duty per Well. | RABI. Duty per Lift. | RABI. Duty per Pair. | KHARIF. Duty per Well. | KHARIF. Duty per Lift. | KHARIF. Duty per Pair. | RABI. Wheat. | RABI. Wheat & Barley. | RABI. Wheat & Gram. | RABI. Barley. | RABI. Barley & Gram. | RABI. Barley & Peas. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Unao—(*Contd.*), ... | 545 | 20 | 1 | 2 | Coolie, | 1·33 | 1·33 | 1·33 | ... | ... | ... | 0·28 4 | ... | ... | ... | ... | ... |
| ,, | 549 | 20 | 1 | 2 | ,, | 0·50 | 0·50 | 0·50 | ... | ... | ... | 0·30 4 | ... | ... | ... | ... | ... |
| Mean, ... | ... | 34 | ... | 2 | Lagor, | 2·30 | 1·93 | 1·93 | ... | ... | ... | 88·4 4 | ... | ... | ... | ... | ... |
| ,, | ... | 20 | ... | 2 | Coolie, | 0·84 | 0·84 | 0·84 | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| Lucknow, ... | 572 | 35 | 1 | 2 | Lagor, | 2·50 | 2·50 | 2·50 | ... | ... | ... | 2·50 3 | ... | ... | ... | ... | ... |
| ,, | 578 | 32 | 1 | 4 | ,, | 4·48 | 4·48 | 2·24 | 0·51 | 0·51 | 0·26 | 4·30 3 | ... | ... | ... | ... | ... |
| ,, | 574 | 35 | 1 | 4 | ,, | 3·41 | 3·41 | 1·71 | 1·06 | 1·06 | 0·53 | 2·25 3 | ... | ... | ... | ... | ... |
| ,, | 555 | 30 | 1 | 6 | Coolie, | 12·65 | 12·65 | 4·22 | ... | ... | ... | 9·90 2 | ... | ... | 2·13 2 | ... | ... |
| ,, | 563 | 25 | 1 | 7 | ,, | 8·00 | 8·00 | 2·29 | ... | ... | ... | 4·00 2 | ... | ... | 4·00 2 | ... | ... |
| ,, | 559 | 24 | 1 | 4 | Lagor, | 13·65 | 13·65 | 6·82 | ... | ... | ... | 7·15 2 | ... | ... | 1·30 2 | ... | ... |
| ,, | 566 | 24 | 1 | 4 | Coolie, | *1·54 | 1·54 | 0·77 | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| ,, | 552 | 22 | 1 | 3 | Lagor, | 3·76 | 3·76 | 2·50 | ... | ... | ... | 3·76 3 | ... | ... | ... | ... | ... |
| ,, | 568 | 17 | 1 | 8 | Coolie, | 16·38 | 16·38 | 4·09 | ... | ... | ... | 9·00 3 | ... | ... | 5·58 2 | ... | ... |
| Mean, ... | ... | 30 | ... | 3·4 | Lagor, | 6·95 | 6·95 | 3·94 | 0·78 | 0·78 | 0·39 | 64·7 3 | ... | ... | 19·1 2 | ... | ... |
| ,, | ... | 24 | ... | 7·0 | Coolie, | 12·34 | 12·34 | 3·53 | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| Hardui, ... | 590 | 30 | 1 | 7 | ,, | 7·00 | 7·00 | 2·00 | ... | ... | ... | 7·00 2 | ... | ... | ... | ... | ... |
| ,, | 588 | 25 | 1 | 6 | Lagor, | 5·30 | 5·30 | 1·73 | 2·00 | 2·00 | 0·66 | 5·30 2 | ... | ... | ... | ... | ... |
| ,, | 591 | 25 | 1 | 4 | ,, | 1·40 | 1·40 | 0·70 | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| ,, | 593 | 16 | 2 | 1 | Ráti, | 2·80 | 2·80 | 5·60 | .... | ... | ... | 2·80 2 | ... | ... | ... | ... | ... |
| ,, | 596 | 16 | 4 | 2 | ,, | 1·56 | 0·78 | 1·56 | ... | ... | ... | 1·56 2 | ... | ... | ... | ... | ... |
| ,, | 598 | 16 | 4 | 2 | ,, | 1·10 | 0·55 | 1·10 | ... | ... | ... | 1·10 2 | ... | ... | ... | ... | ... |
| ,, | 600 | 16 | 14 | 7 | ,, | 7 Wells 7·65 | 1·24 | 2·48 | ... | ... | ... | 7·65 2 | ... | ... | ... | ... | ... |
| ,, | 602 | 10 | 2 | 2 | Dhenkli, | 3·50 | 1·75 | 3·50 | ... | ... | ... | 3·50 3 | ... | ... | ... | ... | ... |
| ,, | 608 | 10 | 4 | 3 | Ráti, | 4·16 | 1·38 | 2·76 | ... | ... | ... | 4·16 2 | ... | ... | ... | ... | ... |
| ,, | 605 | 9·5 | 1 | 1 | Dhenkli, | 2·38 | 2·38 | 4·76 | ... | ... | ... | ... | ... | ... | 1·25 2 | ... | ... |
| Mean, ... | ... | 25 | ... | 5 | Lagor, | 3·35 | 3·35 | 1·21 | 2·00 | 2·00 | 0·66 | 9·00 2 | ... | ... | 3·3 2 | ... | ... |
| ,, | ... | 14 | ... | { | Ráti, Dhenkli, | 1·78 | 1·55 | 3·11 | ... | ... | ... | ... | ... | ... | ... | ... | ... |

* These examples are omitted in the calculations for mean areas, &c.

*Provinces and Oudh, and the number of waterings required for each class of irrigated crop*—1881-83—(Continued.)

| Rabi. | | | | | | | | | | | | Kharif. | | | | | Remarks. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Safflower. | Safflower & Gram. | Safflower & Carrots. | Gram. | Carrots. | Peas. | Oats. | Opium. | Tobacco. | Potatoes. | Garlic. | Garden. | Sugar. | Cotton. | Indian Corn. | Millet. | Indigo. | |
| | | | | | | | 0·55 | | | | 0·50 | | | | | | Area. |
| ... | ... | ... | ... | ... | ... | ... | 10 | ... | ... | ... | 15 | ... | ... | ... | ... | ... | Waterings. |
| | | | | | | | 0·20 | | | | | | | | | | Area. |
| ... | ... | ... | ... | ... | ... | ... | 10 | ... | ... | ... | ... | ... | ... | ... | ... | ... | Waterings. |
| | | | | | | | 7·0 | | | | 4·6 | | | | | | Per cent. area. |
| ... | ... | ... | ... | ... | ... | ... | 10 | ... | ... | ... | 15 | ... | ... | ... | ... | ... | Mean waterings. Area 11·72 |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | |
| | | | | | | | | | | | | | | | | | Area. |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | Waterings. |
| | | | | | | | 0·18 | | | | | 0·51 | | | | | Area. |
| ... | ... | ... | ... | ... | ... | ... | 6 | ... | ... | ... | ... | 12 | ... | ... | ... | ... | Waterings. |
| | | | | | | | 0·46 | | 0·70 | | | 1·06 | | | | | Area. |
| ... | ... | ... | ... | ... | ... | ... | 6 | ... | 9 | ... | ... | 8 | ... | ... | ... | ... | Waterings. |
| | | | | | | | 0·62 | | | | | | | | | | Area. |
| ... | ... | ... | ... | ... | ... | ... | 10 | ... | ... | ... | ... | ... | ... | ... | ... | ... | Waterings. |
| | | | | | | | | | | | | | | | | | Area. |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | Waterings. |
| | | | | | | | | | | | 5·20 | | | | | | Area. |
| ... | ... | ... | ... | ... | ... | .. | ... | ... | ... | ... | 5 | ... | ... | ... | ... | ... | Waterings. |
| | | | | | | | 1·54 | | | | | | | | | | Area. |
| ... | ... | ... | ... | ... | ... | ... | 5 | ... | ... | ... | ... | ... | ... | ... | ... | ... | Waterings. |
| | | | | | | | | | | | | | | | | | Area. |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | Waterings. |
| | | | | | | | | | | | | | | | | | Area. |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | Waterings. |
| | | | | | | | 2·10 | | | | | | | | | | Area. |
| ... | ... | ... | ... | ... | ... | ... | 5 | ... | ... | ... | .. | ... | ... | ... | ... | ... | Waterings. |
| | | | | | | | 7·3 | | 1·0 | | 7·9 | 100·0 | | | | | Per cent. area. |
| ... | ... | ... | ... | ... | ... | ... | 6 | ... | 9 | ... | 5 | 10 | ... | ... | ... | ... | Mean waterings. Area 67·94 |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | |
| | | | | | | | | | | | | | | | | | Area. |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | Waterings. |
| | | | | | | | | | | | | 2·00 | | | | | Area. |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | 8 | ... | ... | ... | ... | Waterings. |
| | | | | | | | | | | | 1·40 | | | | | | Area. |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | 5 | ... | ... | ... | ... | ... | Waterings. |
| | | | | | | | | | | | | | | | | | Area. |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | Waterings. |
| | | | | | | | | | | | | | | | | | Area. |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | Waterings. |
| | | | | | | | | | | | | | | | | | Area. |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | Waterings. |
| | | | | | | | | | | | | | | | | | Area. |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | Waterings. |
| | | | | | | | | | | | | | | | | | Area. |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | Waterings. |
| | | | | | | | 1·13 | | | | | | | | | | Area. |
| ... | ... | ... | ... | ... | ... | ... | 5 | ... | ... | ... | ... | ... | ... | ... | ... | ... | Waterings. |
| | | | | | | | 3·2 | | | | 3·5 | 100·0 | | | | | Per cent. area. |
| ... | ... | ... | ... | ... | ... | ... | 5 | ... | ... | ... | 5 | 8 | ... | ... | ... | ... | Mean waterings. Area 38·85 |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | Total Area, 1481·33 |

ABSTRACT TABLE B.—*Showing Area*

| District. | Depth to water surface. | Class. | RABI. Duty per Well. | RABI. Duty per Lift. | RABI. Duty per Pair. | KHARIF. Duty per Well. | KHARIF. Duty per Lift. | KHARIF. Duty per Pair. | RABI | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | Wheat. | Wheat & Barley. | Wheat & Gram. | Barley. | Barley & Gram. | Barley & Peas. | Safflower. | Safflower & Gram. | Safflower & Carrots. | Gram. | Carrots. | Peas. |
| Cawnpore, ... | 34 | Lagor, | 4·15 | 2·68 | 2·57 | 2·13 | 1·41 | 1·35 | 35·5 | 38·7 | ... | ... | ... | 6·3 | ... | ... | ... | ... | ... | ... |
| Hamirpur, ... | 33 | „ | 4·32 | 2·61 | 2·50 | 2·19 | 1·64 | 1·42 | ... | 3·4 | ... | 12·0 | ... | ... | ... | ... | ... | ... | ... | ... |
| Farukhabad, ... | 51 | „ | 4·21 | 3·15 | 3·10 | 1·45 | 1·45 | 1·45 | 18·7 | 6·4 | ... | 5·37 | ... | ... | ... | ... | ... | ... | ... | ... |
| Mainpuri, ... | 24 | „ | 10·98 | 6·30 | 3·70 | ... | ... | ... | 47·5 | 16·4 | 4·7 | 23·8 | 1·4 | ... | ... | ... | ... | 2·1 | 0·8 | ... |
| Etah, ... | 16 | „ | 5·92 | 3·20 | 2·50 | 1·70 | 0·57 | 0·57 | 56·0 | 3·0 | ... | 31·5 | ... | ... | ... | ... | ... | ... | 4·6 | ... |
| Saharanpur, ... | 17 | „ | 2·90 | 2·90 | 2·05 | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| Shahjahanpur, ... | 33 | „ | 2·29 | 2·29 | 2·29 | ... | ... | ... | 67·2 | ... | ... | 2·1 | ... | ... | ... | ... | ... | ... | ... | ... |
| Unao, ... | 34 | „ | 2·30 | 1·93 | 1·93 | ... | ... | ... | 88·4 | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| Lucknow, ... | 30 | „ | 6·95 | 6·95 | 3·94 | 0·78 | 0·78 | 0·40 | 64·7 | ... | ... | 19·1 | ... | ... | ... | ... | ... | ... | ... | ... |
| Hardui, ... | 25 | „ | 3·35 | 3·35 | 1·21 | 2·00 | 2·00 | 0·60 | 90·0 | ... | ... | 3·3 | ... | ... | ... | ... | ... | ... | ... | ... |
| Shahjahanpur, ... | 37 | Coolie, | 4·50 | 4·50 | 1·50 | 5·00 | 5·00 | 1·66 | ... | ... | ... | ... | ... | ... | .. | ... | ... | ... | ... | ... |
| Unao, ... | 20 | „ | Omitted. 0·84 | 0·84 | 0·84 | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| Lucknow, ... | 24 | „ | 12·34 | 12·34 | 3·53 | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| Hardui, ... | 30 | „ | 7·00 | 7·00 | 2·00 | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| Mainpuri, ... | 17 | Kili, | 11·58 | 4·77 | 3·94 | 2·31 | 0·85 | 0·75 | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| Aligarh, ... | 24 | „ | 12·92 | 7·28 | 4·50 | 3·02 | 2·12 | 1·02 | 50·3 | 3·5 | ... | 24·0 | ... | 9·6 | 0·4 | 0·1 | 1·6 | 2·0 | 2·0 | 1·4 |
| Muttra, ... | 51 | „ | 8·40 | 5·58 | 5·20 | ... | ... | ... | 48·3 | 2·15 | 1·6 | 23·0 | 7·8 | 12·6 | ... | ... | 4·5 | .. | ... | ... |
| Bulandshahr, ... | 24 | „ | 11·36 | 7·50 | 4·18 | 1·81 | 0·85 | 0·55 | 24·6 | 13·1 | 4·6 | 12·9 | ... | 12·8 | 11·0 | ... | ... | 2·3 | ... | 1·8 |
| Meerut, ... | 24 | „ | 11·91 | 7·23 | 3·62 | 6·17 | 2·76 | 1·36 | 58·0 | 6·3 | 8·9 | 6·9 | ... | 8·0 | ... | ... | 0·2 | 0·6 | 0·3 | 2·0 |
| Muzaffarnagar, ... | 12 | „ | 3·53 | 3·53 | 1·77 | 7·95 | 7·95 | 2·42 | 100·0 | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| Bijnor, ... | 16 | „ | ... | ... | ... | 2·40 | 2·40 | 1·32 | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| Moradabad, ... | 19 | „ | 3·91 | 2·93 | 1·63 | 1·17 | 0·82 | 0·42 | 87·5 | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| Bareilly, ... | 38 | „ | 2·90 | 2·63 | 2·63 | ... | ... | ... | 5·0 | ... | ... | ... | ... | ... | ... | .. | ... | ... | ... | ... |
| Farukhabad, ... | 16 | Dhenkli, | 0·60 | 0·60 | 1·20 | ... | ... | ... | .. | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| Bijnor, ... | 20 | „ | 0·75 | 0·75 | 1·50 | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| Moradabad, ... | 15 | „ | 0·95 | 0·47 | 0·95 | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| Pillibhit, ... | 15 | „ | ... | ... | ... | 2·80 | 1·40 | 1·86 | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| Shahjahanpur, ... | 13 | „ | 0·63 | 0·63 | 1·26 | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| Hardui, ... | 10 | „ | 2·94 | 2·07 | 4·13 | ... | ... | ... | 60·0 | ... | ... | 20·0 | ... | ... | ... | ... | ... | .. | ... | ... |
| Rampur State, ... | 21 | Ráti, | 0·22 | 0·22 | 0·44 | ... | ... | ... | ... | .. | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| Bareilly, ... | 9 | „ | 0·50 | 0·50 | 1·00 | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| Shahjahanpur, ... | 24 | „ | 1·74 | 1·16 | 2·32 | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| Hardui, ... | 16 | „ | 1·31 | 1·34 | 2·68 | ... | ... | ... | 100·0 | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |

*commanded by Wells, 1881-83.*

| Percentage. | | | | | | Kharif Percentage. | | | | | Remarks. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Oats. | Opium. | Tobacco. | Potatoes. | Garlic. | Garden. | Sugar. | Cotton. | Indian Corn. | Millet. | Indigo. | |
| ... | 7·7 | 4·9 | 4·0 | ... | 2·9 | ... | 81·2 | ... | ... | 18·8 | |
| ... | 8·8 | 70·5 | ... | ... | 5·3 | 80·2 | 19·8 | ... | ... | ... | |
| ... | 5·8 | 7·2 | 7·2 | ... | 1·0 | ... | ... | 73·8 | 26·2 | ... | |
| ... | 0·9 | 0·4 | 0·5 | ... | 1·5 | ... | ... | ... | ... | ... | |
| 0·5 | 3·0 | ... | ... | ... | ... | 100·0 | ... | ... | ... | ... | |
| ... | ... | ... | ... | ... | 100·0 | ... | ... | ... | ... | ... | |
| ... | ... | 15·2 | ... | ... | 15·0 | ... | ... | ... | ... | ... | |
| ... | 7·0 | ... | ... | ... | 4·6 | ... | ... | ... | ... | ... | |
| ... | 7·3 | ... | 1·0 | .. | 7·9 | 100·0 | ... | ... | ... | ... | The percentage in heavy black type refer merely to the class of lift opposite which they are entered, and are not general percentages of irrigation. |
| ... | 3·2 | ... | ... | ... | 3·5 | 100·0 | ... | ... | ... | ... | |
| ... | ... | ... | ... | ... | ... | 100·0 | ... | ... | ... | ... | |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | |
| ... | ... | .. | ... | ... | ... | ... | ... | ... | ... | ... | *Mean Result per pair of Cattle or Men employed.* |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | |
| ... | ... | ... | ... | ... | ... | 100·0 | ... | ... | ... | ... | |
| 0·05 | 0·2 | 2·7 | 0·6 | 0·55 | 1·00 | ... | 100·0 | ... | ... | ... | |
| ... | ... | ... | ... | ... | 0·05 | ... | ... | ... | ... | ... | |
| 0·3 | ... | 6·1 | ... | ... | 10·5 | 43·7 | 56·3 | ... | ... | ... | |
| 1·6 | ... | 0·1 | 3·7 | ... | 3·4 | 62·8 | 37·2 | ... | ... | ... | |
| ... | ... | ... | ... | ... | ... | 100·0 | ... | ... | ... | ... | |
| ... | ... | ... | ... | ... | ... | 100·0 | ... | ... | ... | ... | |
| ... | ... | 12·5 | ... | ... | ... | 100·0 | ... | ... | ... | ... | |
| ... | ... | 90·8 | ... | ... | 4·2 | ... | ... | ... | ... | ... | |
| ... | ... | ... | ... | ... | 100·0 | ... | ... | ... | ... | ... | |
| ... | ... | ... | ... | ... | 100·0 | ... | ... | ... | ... | ... | |
| ... | ... | ... | ... | ... | 100·0 | ... | ... | ... | ... | ... | |
| ... | ... | ... | ... | ... | ... | 100·0 | ... | ... | ... | ... | |
| ... | ... | ... | ... | ... | 100·0 | ... | ... | ... | ... | ... | |
| ... | 20·0 | ... | ... | ... | ... | ... | ... | ... | ... | ... | |
| ... | ... | 67·0 | ... | ... | 33·0 | ... | ... | ... | ... | ... | |
| ... | ... | ... | ... | ... | 100·0 | ... | ... | ... | ... | ... | |
| ... | ... | ... | ... | ... | 100·0 | ... | ... | ... | ... | ... | |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | |

| Depth to water surface. | Class. | Labor lifting. | Acres irrigated in one season. | | |
|---|---|---|---|---|---|
| | | | Rabi. | Kharif. | Garden. |
| 25 | Kili, | Cattle, | 3·43 | 1·12 | ... |
| 30 | Lagor, | ... | 2·58 | 1·00 | ... |
| 30 | ... | Men, | 2·34 | 1·66 | ... |
| 15 | Dhenkli, | ... | *4·13 | 1·86 | 1·23 |
| 18 | Ráti, | ... | 2·68 | ... | 1·25 |

* Number of experiments and waterings insufficient.

TABLE C.—*Showing depth of watering given to various crops, and calculated loss from absorption in water-courses.*

| District. | Number. | Crop. | No. of waterings required. | Soil. | Length of water-course. | Watering. | Interval. | Experiment. Cubic feet water lifted in the day. | Experiment. Area irrigated in square feet. | Experiment. Depth of water on area in feet. | Experiment. Depth of damp in feet. | Calculated Loss. Excess. Depth. | Calculated Loss. Excess. Length of water-course. | Calculated Loss. Loss. Cubic feet water. | Calculated Loss. Loss. Cubic feet per foot of water-course. | Calculated Loss. Loss. Area. | Calculated Loss. Percentage of area lost. | Remarks. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CAWNPORE. | 2 | Wheat, | 3 | Dumat, | 200 | 1 | ... | 1,290 | 4,440 | ·2905 | ... | | | | | | | |
| | 20 | „ | 2 | „ | 400 | 1 | ... | 1,140 | 1,498 | ·7610 | ... | ·4817 | 50 | 721 | 14·43 | 2,583 | 172·5 | No kyaries and new water-course. |
| | 21 | „ | 3 | „ | 300 | 1 | ... | 2,017 | 15,765 | ·1279 | ... | | | | | | | |
| | 22 | „ | 3 | „ | 1,150 | 1 | .. | 2,017 | 1,442 | 1·398 | .. | 1·1187 | 800 | 1,612 | 2·015 | 5,772 | 358 | Water-course new and not consolidated. First 300 feet same as 21. |
| | Mean | „ | ... | „ | 512 | 1 | ... | 1,616 | 5,786 | 0·2793 | ... | ... | ... | ... | ... | ... | ... | Mean, rejecting 20 and 22. |
| | „ | „ | 3 | „ | 350 | 1 | ... | 1,653 | 10,102 | ·1636 | ... | | | | | | | |
| | ... | Garden, | ... | „ | 100 | ... | 3 | 380 | 4,752 | ·0799 | ... | | | | | | | |
| | 533 | Tobacco, | 10 | „ | 160 | 10 | 12 | 1,181 | 8,165 | ·1446 | ·70 | | | | | | | |
| | 528 | „ | 12 | „ | 270 | 12 | 12 | 1,014 | 7,550 | ·1343 | ·75 | | | | | | | |
| | Mean | „ | ... | „ | 215 | 11 | 12 | 1,097 | 7,857 | ·1396 | ·72 | | | | | | | |
| HAMIRPUR. | 34 | Barley, | 6 | Parwa, | 150 | 1 | ... | 1,139 | 8,286 | ·1374 | ... | | | | | | | |
| | 35 | „ | 6 | „ | 130 | 1 | ... | 835 | 6,020 | ·1387 | ·66 | | | | | | | |
| | Mean | „ | 6 | „ | 140 | 1 | ... | 987 | 7,153 | ·1380 | ·66 | | | | | | | |
| | 31 | Tobacco, | 7 | „ | 200 | ... | ... | 683 | 5,705 | ·1197 | ... | | | | | | | |
| | 32 | „ | 10 | „ | 50 | 2 | ... | 2,447 | 17,020 | ·1437 | ... | | | | | | | |
| | 33 | „ | 10 | „ | 250 | 2 | 20 | 1,285 | 7,551 | ·1701 | ... | ·0193 | 61 | 143 | 2·352 | 951 | 12·6 | |
| | 47 | „ | 5 | „ | 256 | ... | ... | 1,145 | 6,590 | ·1738 | ... | ·0230 | 67 | 151 | 2·262 | 1,005 | 15·2 | |
| | Mean | „ | 8 | „ | 189 | 2 | 20 | 1,390 | 9,216 | ·1508 | ... | | | | | | | |
| FARUKHABAD. | 29 | Garden, | 10 | Rakur, | 350 | ... | ... | 375 | 2,760 | ·1359 | ... | ... | ... | ... | ... | ... | ... | 2 hours' work. |
| | 63 | Barley, | 2 | Dumat, | 510 | 1 | ... | 1,184 | 7,200 | ·1645 | ... | | | | | | | |
| | 66 | „ | 2 | „ | 440 | 1 | ... | 608 | 5,100 | ·1192 | ... | | | | | | | |
| | 69 | „ | 2 | „ | 510 | 1 | ... | 1,544 | 9,862 | ·1565 | ... | | | | | | | |
| | 72 | „ | 2 | „ | 450 | 1 | ... | 1,026 | 4,514 | ·2273 | ... | | | | | | | |
| | Mean | „ | 2 | „ | 477 | 1 | ... | 1,090 | 6,669 | ·1635 | ... | | | | | | | |
| | 78 | Wheat, | 4 | „ | 560 | 2 | ... | 1,089 | 6,027 | ·1807 | ... | | | | | | | |
| | 74 | „ | 4 | „ | 160 | 3 | ... | 1,270 | 5,734 | ·2215 | ... | | | | | | | |
| | Mean | „ | 4 | „ | 360 | 2 | ... | 1,179 | 5,880 | ·2005 | ... | | | | | | | |

TABLE C.—*Showing depth of watering given to various crops, and calculated loss from absorption in water-courses*—(continued).

| District. | Observation. Number. | Crop. | No. of waterings required. | Soil. | Length of water-course. | Watering. | Interval. | Experiment. Cubic feet water lifted in the day. | Area irrigated in square feet. | Depth of water on area in feet. | Depth of damp in feet. | Calculated Loss. *Excess.* Depth. | *Excess.* Length of water-course. | *Loss.* Cubic feet water. | *Loss.* Cubic feet per foot of water-course. | *Loss.* Area. | Percentage of area lost. | Remarks. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FARUKHABAD—*(Continued.)* | 86 | Garden, | 12 | Matyar | 160 | ... | ... | 343 | 3,483 | ·0984 | ... | | | | | | | |
| | 87 | „ | 12 | „ | 220 | ... | ... | 524 | 3,783 | ·1385 | ... | ·0193 | 30 | 72 | 2·428 | 611 | 16·1 | |
| | Mean | „ | 12 | „ | 190 | ... | ... | 433 | 3,633 | ·1192 | ... | | | | | | | |
| | 88 | Tobacco, | 12 | Dumat, | 400 | ... | 5 | 1,142 | 8,286 | ·1378 | ·75 | | | | | | | |
| | 90 | „ | 10 | „ | 300 | ... | ... | 1,684 | 12,509 | ·1346 | ·75 | | | | | | | |
| | 92 | „ | 10 | „ | 250 | ... | ... | 1,280 | 8,448 | ·1515 | ·66 | | | | | | | |
| | 94 | „ | 10 | „ | 400 | ... | ... | 1,546 | 8,464 | ·1826 | ·75 | ·0299 | 50 | 253 | 5·060 | 1,657 | 19·5 | |
| | Mean | „ | 10 | „ | 350 | ... | 5 | 1,413 | 9,253 | ·1527 | ·73 | | | | | | | |
| | 136 | Wheat, | 3 | „ | 450 | 1 | ... | 1,178 | 4,890 | ·2409 | ·80 | | | | | | | |
| | 110 | „ | 3 | „ | 910 | 2 | 30 | 5,629 | 23,049 | ·2442 | ·55 | ·0187 | 184 | 431 | 2·343 | 1,911 | 8·3 | |
| | 123 | „ | 3 | „ | 800 | 2 | 30 | 3,603 | 15,362 | ·2346 | ·75 | ·0091 | 74 | 139 | 1·889 | 619 | 4·0 | |
| | 131 | „ | 3 | Matyar, | 370 | 2 | 60 | 2,511 | 8,027 | ·3128 | 1·00 | ... | ... | ... | ... | ... | ... | Damp in excess. |
| | 133 | „ | 3 | Dumat, | 680 | 2 | 30 | 1,598 | 7,509 | ·2128 | ·75 | | | | | | | |
| | 138 | „ | 3 | „ | 370 | 2 | 37 | 2,217 | 13,322 | ·1664 | ·66 | | | | | | | |
| | 140 | „ | 3 | „ | 340 | 2 | 45 | 1,934 | 13,450 | ·1438 | ·50 | | | | | | | |
| | 141 | „ | 3 | „ | 240 | 2 | 30 | 1,203 | 7,240 | ·1662 | ·50 | | | | | | | |
| | 147 | „ | 4 | „ | 180 | 2 | 30 | 1,074 | 5,332 | ·2014 | ·80 | | | | | | | |
| MAINPURI. | 150 | „ | 3 | Matyar, | 970 | 2 | 60 | 1,835 | 10,055 | ·1825 | ·50 | ... | ... | ... | ... | ... | ... | Damp deficient. |
| | 153 | „ | 3 | Dumat, | 410 | 2 | 30 | 4,394 | 19,230 | ·2285 | ·70 | | | | | | | |
| | 167 | „ | 4 | Mixed, | 2,400 | 2 | 40 | 6,697 | 18,040 | ·3712 | 1·00 | ·1457 | 1,674 | 2,628 | 1·570 | 11,650 | 64·6 | |
| | 128 | „ | 3 | Dumat, | 1,050 | 3 | 45 | 3,388 | 19,434 | ·1743 | ·75 | | | | | | | |
| | Mean | „ | 3 | „ | 726 | 2 | 39 | 3,007 | 13,335 | ·2255 | ·70 | | | | | | | |
| | 96 | Gujai, | 2 | Sandy, | 600 | 1 | ... | 1,475 | 9,775 | ·1509 | ·50 | | | | | | | |
| | 143 | „ | 2 | Dumat, | 560 | 1 | ... | 2,660 | 11,400 | ·2333 | ·80 | ... | ... | ... | ... | ... | ... | Damp in excess. |
| | Mean | „ | 2 | „ | 580 | 1 | ... | 2,067 | 10,587 | ·1953 | ·65 | | | | | | | |
| | 106 | „ | 3 | „ | 1,060 | 2 | 20 | 4,294 | 33,107 | ·1297 | ·75 | | | | | | | |
| | 113 | „ | 3 | „ | 1,280 | 2 | 45 | 3,518 | 14,904 | ·2360 | ·66 | ·0733 | 110 | 1,092 | 9·931 | 6,714 | 45·0 | Interval in excess. |
| | Mean | „ | 3 | „ | 1,170 | 2 | 32 | 3,906 | 24,005 | ·1627 | ·70 | | | | | | | |

TABLE C.—*Showing depth of watering given to various crops, and calculated loss from absorption in water-courses*—(continued).

| District. | Number. | Crop. | Observation: No. of waterings required. | Soil. | Length of water-course. | Watering: | Interval. | Experiment: Cubic feet water lifted in the day. | Area irrigated in square feet. | Depth of water on area in feet. | Depth of damp in feet. | Calculated Loss: *Excess.* Depth. | *Excess.* Length of water-course. | *Loss.* Cubic feet water. | *Loss.* Cubic feet per foot of water-course. | *Loss.* Area. | Percentage of area lost. | Remarks. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Mainpuri—(*Continued.*) | 100 | Guchana, | 2 | Dumat, | 1,120 | 1 | ... | 3,718 | 15,362 | ·2421 | ·75 | | | | | | | |
| | 155 | „ | 3 | „ | 1,760 | 2 | 45 | 5,890 | 24,356 | ·2003 | ·55 | | | | | | | |
| | 117 | Barley, | 2 | „ | 1,710 | 2 | 30 | 6,650 | 22,000 | ·3023 | ·75 | ·0603 | 503 | 1,327 | 2·637 | 5,482 | 24·9 | |
| | 120 | „ | 2 | „ | 370 | 2 | 45 | 3,280 | 14,330 | ·2289 | ·80 | | | | | | | |
| | 160 | „ | 3 | „ | 1,045 | 2 | 42 | 5,586 | 31,193 | ·1791 | ·55 | | | | | | | |
| | 170 | „ | 3 | „ | 810 | 2 | 45 | 1,403 | 8,252 | ·1700 | ·70 | | | | | | | |
| | 173 | „ | 2 | Matyar | 2,100 | 2 | 50 | 3,815 | 9,892 | ·3857 | ·80 | ·1437 | 893 | 1,422 | 1·592 | 5,874 | 59·4 | |
| | Mean | „ | 2to 3 | „ | 1,207 | 2 | 43 | 4,147 | 17,133 | ·2420 | ·72 | | | | | | | |
| Etah. | 166 | Carrots, | 10 | Mixed, | 660 | 2 | ... | 1,628 | 11,166 | ·1459 | ·60 | | | | | | | |
| | 178 | Wheat, | 4 | Matyar | 1,960 | 2 | 60 | 2,974 | 10,934 | ·2723 | ·55 | ·0450 | 1,188 | 491·8 | 0·414 | 2,164 | 19·8 | |
| | 180 | „ | 4 | „ | 650 | 2 | 45 | 2,037 | 10,025 | ·2032 | ·60 | | | | | | | |
| | 183 | „ | 4 | Dumat, | 370 | 2 | 60 | 2,140 | 6,840 | ·3161 | 1·00 | ... | ... | ... | ... | ... | ... | Damp in excess. |
| | 188<br>189 | „ | 4 | „ | 660 | 3 | 30 | 5,131 | 33,300 | ·1541 | ·70 | | | | | | | |
| | 192 | „ | 4 | „ | 220 | 3 | 30 | 2,886 | 5,630 | ·5126 | ·66 | | | | | | | |
| | Mean | „ | 4 | „ | 772 | 2 to 3 | 45 | 3,034 | 13,346 | ·2273 | ·70 | | | | | | | |
| | 196 | Barley,<br>Oats, | 3<br>6 | „<br>„ | ...<br>780 | ...<br>5 | 3<br>30 | 2,122 | 13,943 | ·1522 | ·50 | | | | | | | |
| | 218 | Wheat, | 3 | „ | 1,600 | 2 | 30 | 4,374 | 16,557 | ·2642 | ·75 | ·0154 | 532 | 255 | 0·479 | 1,025 | 6·2 | |
| | 221 | „ | 3 | „ | 430 | 2 | 30 | 3,325 | 18,663 | ·1782 | ·80 | | | | | | | |
| | 259 | „ | 3 | „ | 1,650 | 2 | 30 | 13,888 | 12,758 | ·2632 | ·75 | ·0144 | 582 | 759 | 1·305 | 3,054 | 5·8 | |
| | 265 | Barley,<br>Wheat, | 2<br>3 | „ | 1,500 | 2 | ... | 14,880 | 54,428 | ·2734 | ·85 | ·0246 | 432 | 1063 | 2·462 | 4,275 | 7·8 | Damp in excess. |
| Aligarh. | 203 | Wheat, | 3 | „ | 1,260 | 3 | 30 | 1,691 | 8,708 | ·1942 | ·62 | ... | ... | ... | ... | ... | ... | Damp deficient. |
| | 207 | „ | 4 | Matyar | 610 | 3 | 37 | 3,638 | 15,440 | ·2356 | ·75 | | | | | | | |
| | 211 | „ | 4 | „ | 980 | 3 | 45 | 3,865 | 30,540 | ·1266 | ·16 | ... | ... | ... | ... | ... | ... | Damp deficient. |
| | 231 | „ | 5 | Dumat, | 460 | 3 | 30 | 2,375 | 15,945 | ·1490 | ·70 | | | | | | | |
| | 242 | Garlic,<br>Wheat, | 10<br>5 | „<br>„ | 3<br>225 | 6<br>3 | 15<br>60 | ...<br>1,982 | 8,430<br>6,924 | ...<br>·1291 | ·75<br>·60 | ... | ... | ... | ... | ... | ... | Mixed crops. |
| | 268 | Wheat, | 3 | „ | 1,500 | 3 | 60 | 4,200 | 13,420 | ·3130 | ·75 | ·0642 | 432 | 861 | 2·00 | 3,463 | 25·8 | |
| | 269 | „ | 3 | „ | 1,000 | 3 | 60 | 4,853 | 17,990 | ·2698 | ·80 | ... | ... | ... | ... | ... | ... | Damp in excess. |
| | Mean | „ | 3 to5 | „ | 983 | 2 to 3 | 42 | 5,370 | 23,618 | ·1806 | ·70 | | | | | | | |

TABLE C.—*Showing depth of watering given to various crops, and calculated loss from absorption in water-courses*—(continued).

| District. | Number. | Crop. | No. of waterings required. | Soil. | Length of water-course. | Watering. | Interval. | Experiment. Cubic feet water lifted in the day. | Experiment. Area irrigated in square feet. | Experiment. Depth of water on area in feet. | Experiment. Depth of damp in feet. | Calculated Loss. Excess. Depth. | Calculated Loss. Excess. Length of water-course. | Calculated Loss. Loss. Cubic feet water. | Calculated Loss. Loss. Cubic feet per foot of water-course. | Calculated Loss. Loss. Area. | Calculated Loss. Percentage of area lost. | Remarks. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ALIGARH—(*Continued.*) | Mean | Wheat, | 3 to 5 | Dumat, | 1,068 | 2 to 3 | 38 | 5,914 | 23,768 | ·2488 | ·75 | ... | ... | .. | ... | ... | ... | Omitting 211 and 242. |
| | 217 | Barley, | 2 | „ | 300 | 2 | 60 | 4,033 | 17,082 | ·2361 | ·80 | ... | ... | ... | ... | ... | ... | Damp in excess. |
| | 257 | „ | 3 | „ | 580 | 2 | 30 | 1,348 | 4,378 | ·3079 | ·85 | ·1036 | 140 | 453 | 3·24 | 2,220 | 50·7 | Damp in excess. |
| | 200 | „ | 3 | „ | 420 | 3 | 30 | 1,642 | 10,600 | ·1549 | ·75 | | | | | | | |
| | 234 | „ | 3 | „ | 790 | 3 | 30 | ... | 15,360 | ... | ·70 | | | | | | | |
| | | Tobacco, | 10 | „ | 320 | 2 | ... | 4,029 | 3,836 | ·2099 | 1·10 | ·0056 | 350 | 107 | 0·307 | 526 | 2·74 | Doubtful mixed crops. |
| | 239 | Barley, | 4 | „ | 300 | 3 | 35 | 1,270 | 6,834 | ·1858 | ·80 | | | | | | | |
| | 251 | Wheat, | 4 | „ | 460 | ... | ... | ... | 5,066 | ... | ·80 | | | | | | | |
| | | Barley, | 3 | „ | 140 | 3 | 60 | 2,850 | 2,640 | ·3699 | ·60 | ... | ... | ... | ... | ... | ... | Damp in excess. |
| | 275 | Peas, | ... | „ | 650 | 3 | 60 | 3,734 | 26,842 | ·1391 | 1·00 | ... | ... | ... | ... | ... | ... | Mixed crops. |
| | | Barley, | 3 | | | | | | | | | | | | | | | |
| | Mean | Barley, | 3 | „ | 440 | 2 to 3 | 43 | 2,701 | 13,220 | ·2043 | ·79 | | | | | | | |
| | 255 | Kurfa, | 4 | „ | 300 | 2 | 6 | 1,485 | 12,600 | ·1179 | ·90 | | | | | | | |
| | | Garden, | | | | | | | | | | | | | | | | |
| | 279 | Carrots, | 5 | „ | 600 | 3 | 20 | 2,295 | 15,207 | ·1509 | ·70 | | | | | | | |
| | 291 | Barley, | 3 | Sandy, | 520 | 1 | ... | 1,862 | 7,811 | ·2384 | ·90 | | | | | | | |
| | 325 | „ | 2 | „ | 550 | 2 | 60 | 2,600 | 16,524 | ·1574 | 1·2 | | | | | | | |
| MUTTRA. | 300 | Wheat, | 4 | Dumat, | 1,020 | 2 | 67 | 1,565 | 6,336 | ·2470 | ·70 | ·0778 | 496 | 493 | 1·00 | 2,913 | 46·0 | |
| | 312 | „ | 4 | Sandy, | 120 | 2 | 60 | 1,143 | 6,504 | ·1761 | 1·10 | ... | ... | ... | ... | ... | ... | Damp in excess. |
| | 307 | „ | 4 | Dumat, | 500 | 3 | 45 | 1,800 | 13,024 | ·1382 | ·50 | ... | ... | ... | ... | ... | ... | Damp deficient. |
| | 309 | „ | 3 | Mixed, | 570 | 3 | 45 | 1,247 | 10,047 | ·1241 | ·66 | ... | ... | ... | ... | ... | ... | Damp deficient. |
| | 287 | „ | 5 | | | | | | | | | | | | | | | |
| | | Guchana, | 5 | Sandy, | 180 | 4 | 30 | 1,484 | 11,037 | ·1345 | ·83 | | | | | | | |
| | 315 | Wheat, | 5 | | | | | | | | | | | | | | | |
| | | Gujai, | 4 | Dumat, | 340 | 4 | 30 | 1,875 | 12,725 | ·1474 | 1·00 | | | | | | | |
| | 319 | Wheat, | 5 | „ | 940 | 4 | 30 | 2,490 | 8,926 | ·2790 | ·80 | ·1098 | 416 | 980 | 2·356 | 5,792 | 64·9 | |
| | Mean | „ | 4to 5 | „ | 524 | 2 to 4 | 44 | 1,658 | 9,800 | ·1692 | ·80 | | | | | | | |
| | 346 | Tobacco, | 15 | „ | 790 | 1 | ... | 2,550 | 10,700 | ·2383 | ·66 | ·0297 | 183 | 317 | 1·73 | 1,523 | 14·2 | |
| | 374 | „ | 8 | „ | 670 | 1 | ... | 2,921 | 11,856 | ·2464 | 1·00 | ·0374 | 63 | 448 | 7·116 | 2,149 | 18·1 | Damp in excess. |
| | 400 | „ | 8 | Matyar, | 360 | 1 | ... | 1,738 | 12,000 | ·1448 | 1·00 | | | | | | | |
| | Mean | „ | 10 | „ | 607 | 1 | ... | 2,403 | 11,518 | ·2086 | ·88 | | | | | | | |
| BULANDSHAHR. | 369 | „ | 8 | Dumat, | 430 | 2 | 5 | 2,362 | 20,000 | ·1181 | ·60 | | | | | | | |
| | 394 | Gujai, | 4 | Matyar, | 750 | 2 | 45 | 3,693 | 15,000 | ·2462 | ·75 | | | | | | | |
| | 381 | Garden, | 7 | Dumat, | 300 | 1 | ... | 1,871 | 7,920 | ·2362 | 1·5 | | | | | | | |

TABLE C.—*Showing depth of watering given to various crops, and calculated loss from absorption in water-courses*—(continued).

| District. | Number. | Crop. | No. of waterings required. | Soil. | Length of water-course. | Watering. | Interval. | Cubic feet water lifted in the day. | Area irrigated in square feet. | Depth of water on area in feet. | Depth of damp in feet. | Calculated Loss. Excess. Depth. | Excess. Length of water-course. | Loss. Cubic feet water. | Loss. Cubic feet per foot of water-course. | Loss. Area. | Percentage of area lost. | Remarks. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | OBSERVATION. | | | | | EXPERIMENT. | | | | CALCULATED LOSS. | | | | | | |
| BULANDSHAHR. | 386 | Garden, | 7 | Dumat, | 230 | 4 | 20 | 3,022 | 15,000 | ·2015 | 1·5 | | | | | | | |
| | 389 | „ | 7 | „ | 500 | 4 | 30 | 4,350 | 24,160 | ·1800 | 1·2 | | | | | | | |
| | 359 | „ | 7 | „ | 810 | 5 | 25 | 3,453 | 22,680 | ·1523 | 1·4 | | | | | | | |
| | Mean | „ | 7 | „ | 513 | 4 | 25 | 3,608 | 20,920 | ·1725 | 1·4 | | | | | | | |
| MEERUT. | 430 | Barley, | 3 | Sandy, | 1,400 | 3 | 60 | 11,160 | 44,800 | ·2491 | ·80 | | | | | | | |
| | 434 | Potatoes, | 10 | Matyar | 640 | 4 | 10 | 3,037 | 38,577 | ·0787 | ·75 | | | | | | | |
| | 434 | Wheat, | 3 | „ | 370 | 2 | 60 | 2,710 | 10,880 | ·2491 | ·75 | | | | | | | |
| | 434 | „ | 3 | „ | 350 | 2 | 60 | 2,860 | 14,600 | ·1959 | ·66 | | | | | | | |
| | 439 | „ | 3 | „ | 3,831 | 2 | 60 | 3,831 | 11,907 | ·3218 | ·66 | ·0508 | 233 | 605 | 2·597 | 2,233 | 18·7 | |
| | 441 | „ | 3 | „ | 1,020 | 2 | 60 | 4,203 | 15,557 | ·2702 | ·66 | ... | ... | ... | ... | ... | ... | Same water-course as 439, which was still wet. |
| | 406 | „ | 4 | Sandy, | 810 | 3 | 75 | 3,100 | 6,918 | ·4481 | ·75 | ·1771 | 23 | 1225 | 53·27 | 4,521 | 65·3 | Sandy doubtful. |
| | 412<br>414 | „ | 4<br>4 | „ | 923 | 3 | 75 | 9,545 | 39,374 | ·2424 | ·90 | | | | | | | |
| | 425 | „ | 4 | „ | 1,020 | 3 | 60 | 6,610 | 22,000 | ·3004 | ·90 | ·0294 | 233 | 646 | 2·776 | 2,387 | 10·8 | |
| | Mean | „ | 3 to 4 | „ | 787 | 2 to 3 | 64 | 4,694 | 17,320 | ·2710 | ·75 | | | | | | | |
| MUZAFFARNAGAR. | 444 | Sugar, | 5 | Dumat, | 800 | 1 | ... | 6,111 | 20,770 | ·2942 | 1·0 | | | | | | | |
| SAHARANPUR. | 449 | Potatoes, | 10 | „ | 500 | 3 | 20 | 1,510 | 15,175 | ·0995 | ·80 | | | | | | | |
| | 451 | Garden, | 10 | „ | 175 | 3 | 8 | 2,047 | 21,134 | ·0968 | ·80 | | | | | | | |
| | 465 | Sugar, | 3 | „ | 660 | 1 | ... | 3,819 | 17,578 | ·2173 | ·75 | | | | | | | |
| | 465 | „ | 3 | „ | 1,380 | 1 | ... | 5,015 | 22,208 | ·2258 | ·66 | | | | | | | |
| | 467 | „ | 3 | „ | 2,030 | 1 | ... | 4,678 | 13,531 | ·3458 | ·75 | ·0928 | 673 | 1,255 | 1·866 | 4,963 | 36·7 | |
| BIJNOR. | Mean | „ | 3 | „ | 1,356 | 1 | ... | 4,504 | 17,772 | ·2530 | ·71 | | | | | | | |
| | 461 | Garden, | 10 | Matyar | 100 | *x* | ... | 350 | 6,453 | ·0542 | ·80 | | | | | | | |
| | 463 | „ | 10 | „ | 60 | *x* | ... | 114 | 3,460 | ·0329 | ·60 | | | | | | | |
| | Mean | „ | 10 | „ | $8_0$ | ... | ... | 232 | 4,956 | ·04681 | ·70 | | | | | | | |
| MORADABAD. | 471<br>472 | Sugar, | 4 | Dumat, | $80_0$ | | 1 ... | 4,162 | 16,089 | ·2587 | ·75 | ·0030 | 373 | 48 | ·129 | 188 | 1·1 | Damp deficient. |
| | 480 | „ | 4 | Sandy, | $18_0$ | | 1 ... | 1,590 | 7,800 | ·2039 | ·80 | | | | | | | |
| | 484 | „ | 4 | „ | $30_0$ | | 1 ... | 1,379 | 4,000 | ·3448 | 1·2 | ... | ... | ... | ... | ... | ... | Damp in excess. |
| | Mean | „ | 4 | „ | $42_7$ | | 1 ... | 2,377 | 9,296 | ·2557 | ·91 | | | | | | | |

TABLE C.—*Showing depth of watering given to various crops, and calculated loss from absorption in water-courses*—(continued).

| District. | Number. | Crop. | No. of waterings required. | Soil. | Length of water-course. | Watering. | Interval. | Experiment. Cubic feet water lifted in the day. | Area irrigated in square feet. | Depth of water on area in feet. | Depth of damp in feet. | Calculated Loss. *Excess.* Depth. | *Excess.* Length of water-course. | *Loss.* Cubic feet water. | *Loss.* Cubic feet per foot of water-course. | *Loss.* Area. | Percentage of area lost. | Remarks. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Moradabad. | 476 | Tobacco, | 30 | Dumat, | 270 | 6 | 3 | 985 | 15,340 | ·0642 | ·80 | | | | | | | |
| Rampur. | 478 | „ | 30 | „ | 230 | 6 | 4 | 1,010 | 13,280 | ·0760 | ·70 | | | | | | | |
| | | „ | 30 | „ | 250 | 6 | 3·5 | 997 | 14,310 | ·0696 | ·75 | | | | | | | |
| | 488 | „ | 28 | Dumat, | 100 | 16 | 5 | 276 | 3,546 | ·0778 | ·66 | | | | | | | |
| | 497 | Garden, | 10 | Matyar, | 160 | 1 | ... | 252 | 3,000 | ·0840 | ·60 | | | | | | | |
| Bareilly. | 490 | Tobacco, | 20 | Dumat, | 1130 | 10 | 7 | 1,974 | 14,200 | ·1390 | ·85 | ... | ... | ... | ... | ... | ... | Damp in excess |
| | 491 | „ | 20 | „ | 500 | 10 | 7 | 2,035 | 14,770 | ·1378 | ·80 | | | | | | | |
| | 492 | „ | 20 | „ | 470 | 10 | 7 | 870 | 5,175 | ·1681 | ·75 | | | | | | | |
| | 494 | „ | 20 | „ | 320 | 12 | 7 | 708 | 6,080 | ·1190 | ·75 | | | | | | | |
| | Mean | „ | 20 | „ | 580 | 10 to 12 | 7 | 1,397 | 10,058 | ·1389 | ·79 | | | | | | | |
| Pillibhit. | 501 | Sugar, | 2 | Sandy, | 230 | 1 | ... | 423 | 8,027 | ·0527 | ·70 | | | | | | | |
| | 505 | „ | 2 | Dumat, | 930 | 1 | ... | 1,974 | 7,200 | ·2742 | 1·0 | | | | | | | |
| Shahjahanpur. | 514 | Tobacco, | 20 | „ | 300 | 10 | 6 | 1,984 | 12,995 | ·1527 | ·90 | | | | | | | |
| | 517 | „ | 20 | „ | 230 | 10 | 10 | 1,752 | 10,170 | ·1723 | ·80 | | | | | | | |
| | Mean | „ | 20 | „ | 265 | 10 | 8 | 1,868 | 11,582 | ·1613 | ·85 | | | | | | | |
| | 520 | Garden, | 20 | Matyar, | 120 | ... | 4 | 360 | 3,706 | ·0971 | ·60 | | | | | | | |
| | 522 | „ | 20 | „ | 140 | ... | ... | 385 | 2,534 | ·1519 | ·60 | | | | | | | |
| | 524 | „ | 20 | „ | 150 | ... | ... | 905 | 7,590 | ·1192 | ·90 | | | | | | | |
| | Mean | „ | 20 | „ | 137 | ... | ... | 550 | 4,610 | ·1193 | ·70 | | | | | | | |
| Lucknow. | 552 | Wheat, | 3 | Dumat, | 400 | 1 | ... | 1,197 | 5,000 | ·2394 | ... | | | | | | | |
| | 555 | „ | 2 | Mixed, | 1,300 | 1 | ... | 1,845 | 16,000 | ·1153 | ... | | | | | | | |
| | 568 | „ | 3 | „ | 790 | 1 | ... | 4,968 | 24,000 | ·2070 | ... | ·0335 | 38 | 804 | 22·67 | 4,634 | 19·3 | |
| | 586 | „ | 3 | Dumat, | 420 | 1 | ... | 468 | 3,850 | ·1215 | ... | | | | | | | |
| | Mean | „ | 3 | „ | 752 | 1 | ... | 2,119 | 12,212 | ·1735 | ... | | | | | | | |
| | 578 | „ | 3 | Matyar, | 1,120 | 2 | 30 | 1,136 | 7,290 | ·1558 | ... | | | | | | | |
| | 584 | „ | 3 | Dumat, | 580 | 2 | .. | 1,037 | 6,250 | ·1659 | ... | | | | | | | |
| | Mean | „ | 3 | „ | 850 | 2 | 30 | 1,086 | 6,770 | ·1604 | ... | | | | | | | |
| Hardui. | 581 | Peas, | 2 | „ | 690 | 2 | ... | 1,321 | 13,500 | ·0978 | ... | | | | | | | |

TABLE C.—*Showing depth of watering given to various crops, and calculated loss from absorption in water-courses*—(continued).

| District. | Observation. Number. | Crop. | No. of waterings required. | Soil. | Length of water-course. | Watering. | Interval. | Experiment. Cubic feet water lifted in the day. | Area irrigated in square feet. | Depth of water on area in feet. | Depth of damp in feet. | Calculated Loss. *Excess.* Depth. | Length of water-course. | *Loss.* Cubic feet water. | Cubic feet per foot of water-course. | Area. | Percentage of area lost. | Remarks. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| HARDUI. | 590 | Wheat, | 2 | Matyar, | 505 | 1 | ... | 1,470 | 5,866 | ·2506 | ... | ·0131 | 193 | 76 | ·398 | 323 | 5·5 | |
| | 608 | „ | 2 | Dumat, | 120 | 1 | ... | 540 | 2,600 | ·2125 | ... | | | | | | | |
| | Mean | „ | 2 | „ | 312 | 1 | ... | 1,005 | 4,233 | ·2375 | ... | | | | | | | |
| | 588 | „ | 2 | Matyar, | 510 | 2 | 30 | 1,298 | 8,425 | ·1538 | ... | | | | | | | |
| | 602<br>603 | Opium, | 5 | „ | 130 | 1 | ... | 975 | 4,055 | ·2350 | ... | | | | | | | |
| | 605 | „ | 5 | „ | 150 | 1 | ... | 424 | 3,077 | ·1378 | ... | | | | | | | |
| | 609 | „ | 5 | Dumat, | 500 | 1 | ... | 498 | 4,100 | ·1215 | ... | | | | | | | |
| | Mean | „ | 5 | „ | 260 | 1 | ... | 632 | 3,744 | ·1688 | ... | | | | | | | |

ABSTRACT TABLE C.—*Showing loss by Percolation in water-courses per foot run per day of 9 hours.*

| Number. | Soil. | Excess length of water-course. | Loss per foot of water-course. | Time in hours. | Loss reduced to working day. | No. of lifts. | Percentage of area lost. | Remarks. |
|---|---|---|---|---|---|---|---|---|
| 33 | Parwa, .. | 61 | 2·352 | 7·75 | 2·731 | 1 | 12·6 | |
| 47 | „ .. | 67 | 2·262 | 7·35 | 2·770 | 1 | 15·2 | |
| | Mean, .. | 64 | .. | .. | 2·75 | 1 | 13·9 | |
| 87 | Matyar, .. | 30 | 2·428 | 7·4 | 2·953 | 1 | 16·1 | |
| 439 | „ .. | 233 | 2·597 | 9·75 | 2·381 | 1 | 18·7 | |
| 590 | „ .. | 193 | 0·398 | 9·12 | 0·395 | 1 | 5·5 | |
| 178 | „ .. | 1,188 | 0·414 | 9·3 | 0·410 | 3 | 19·8 | |
| 173 | „ .. | 893 | 1·592 | 10·3 | 1·391 | 4 | 59·4 | |
| | Mean, .. | 507 | .. | .. | 1·506 | .. | 29·7 | Numbers 113, 234, 374, 406, 471, 472, and 568, have been omitted from this Table on account of disturbing influences which are noted in Table C. |
| 94 | Dumat, .. | 50 | 5·060 | 8·85 | 5·146 | 1 | 19·5 | The loss by percolation is calculated by assuming the mean depth of each class as correct for the length of its corresponding water-courses, the excess depth of watering representing the loss for the extra length of water-course. |
| 257 | „ .. | 140 | 3·24 | 8·0 | 3·645 | 1 | 50·7 | |
| 346 | „ .. | 183 | 1·73 | 6·7 | 2·324 | 1 | 14·2 | The result is curiously uniform, the few inconsistent figures being easily accounted for by the varying age or condition of some water-courses. |
| 467 | „ .. | 673 | 1·866 | 13·0 | 1·292 | 1 | 36·7 | |
| 22 | „ .. | 800 | 2·015 | 8·88 | 2·042 | 2 | 358·0 | The mean result gives a loss of 2·372 cubic feet per foot of water-course for a working day of 9 hours, but in calculation it will be safer to deduct 200 feet in every instance from the total length, and to estimate the loss at 2·0 on the balance only, as the first 200 feet of water-course near most wells is thoroughly consolidated. |
| 123 | „ .. | 74 | 1·889 | 10·5 | 1·620 | 2 | 4·0 | |
| 218 | „ .. | 532 | 0·479 | 9·5 | 0·475 | 2 | 6·2 | |
| 268 | „ .. | 432 | 2·000 | 9·0 | 2·000 | 2 | 25·8 | |
| 300 | „ .. | 496 | 1·000 | 7·7 | 1·170 | 2 | 46·0 | The percentages of loss of area vary according to the crop, and those shown in this Table only represent the loss on the excess length of water-course. |
| 319 | „ .. | 416 | 2·356 | 10·12 | 2·095 | 2 | 64·9 | |
| 110 | „ .. | 184 | 2·343 | 10·7 | 2·000 | 4 | 8·3 | |
| 117 | „ .. | 503 | 2·637 | 10·0 | 2·373 | 4 | 24·9 | |
| 167 | Mixed, .. | 1,674 | 1·570 | 9·45 | 1·495 | 6 | 64·6 | |
| 259 | Dumat, .. | 582 | 1·305 | 8·0 | 1·468 | 7 | 5·8 | |
| 265 | „ .. | 432 | 2·462 | 8·0 | 2·520 | 8 | 7·8 | |
| | Mean, .. | 478 | .. | .. | 2·111 | .. | 49·1 | |
| 425 | Sandy, .. | 233 | 2·776 | 10·5 | 2·380 | 2 | 10·8 | |

TABLE E.—*Showing Mean Depths of Waterings per Crop, and District, and average interval between each Watering.*

| District. | WHEAT. | | | | | | GUJAI (WHEAT AND BARLEY). | | | | | | GUCHANA (WHEAT AND GRAM). | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Length of water-course. | *Depth of Watering.* First. | Interval. | Second, &c. | Depth of damp. | Soil. | Length of water-course. | *Depth of Watering.* First. | Interval. | Second, &c | Depth of damp. | Soil. | Length of water-course. | *Depth of Watering.* First. | Interval. | Second, &c. | Depth of damp. | Soil. |
| Cawnpore, .. | 512 | ·2793 | .. | .. | .. | Dumat. | | | | | | | | | | | | |
| Hamirpur, .. | .. | .. | .. | .. | .. | .. | | | | | | | | | | | | |
| Farukhabad, .. | 360 | .. | .. | ·2005 | .. | .. | | | | | | | | | | | | |
| Mainpuri, .. | 450 | ·2409 | .. | .. | ·80 | .. | 580 | ·1953 | .. | .. | ·65 | Sandy, Dumat, | 1,120 | ·2421 | .. | .. | ·75 | Dumat. |
| ,, .. | 726 | .. | 39 | ·2255 | ·70 | Dumat, Matyar, | 1,170 | .. | 32 | ·1627 | ·70 | Dumat, | 1,760 | .. | 45 | ·2003 | ·55 | ,, |
| Etah, .. | 772 | .. | 45 | ·2273 | ·70 | Dumat. Matyar. | | | | | | | | | | | | |
| Aligarh, .. | 983 | .. | 42 | ·1806 | ·70 | Dumat. Matyar. | | | | | | | | | | | | |
| Muttra, .. | .. | .. | .. | .. | .. | .. | | | | | | | | | | | | |
| ,, .. | 524 | .. | 44 | ·1692 | ·80 | Sandy. Dumat. | | | | | | | | | | | | |
| Bulandshahr, .. | .. | .. | .. | .. | .. | .. | | | | | | | | | | | | |
| ,, .. | .. | .. | .. | .. | .. | .. | 750 | .. | 45 | ·2462 | ·75 | Matyar. | | | | | | |
| Meerut, .. | 787 | .. | 64 | ·2710 | 0·75 | Sandy. Matyar. | | | | | | | | | | | | |
| Muzaffarnagar, | .. | .. | .. | .. | .. | .. | | | | | | | | | | | | |
| Saháranpur, .. | .. | .. | .. | .. | .. | .. | | | | | | | | | | | | |
| Bijnor, .. | .. | .. | .. | .. | .. | .. | | | | | | | | | | | | |
| Moradabad, .. | .. | .. | .. | .. | .. | .. | | | | | | | | | | | | |
| Rampur, .. | .. | .. | .. | .. | .. | .. | | | | | | | | | | | | |
| Bareilly, .. | .. | .. | .. | .. | .. | .. | | | | | | | | | | | | |
| Pillibhit, .. | .. | .. | .. | .. | .. | .. | | | | | | | | | | | | |
| Shahjahanpur, | .. | .. | .. | .. | .. | .. | | | | | | | | | | | | |
| Lucknow, .. | 752 | ·1735 | .. | .. | .. | Dumat. | | | | | | | | | | | | |
| ,, .. | 850 | .. | 30 | ·1604 | .. | Dumat. Matyar. | | | | | | | | | | | | |
| Hardui, .. | 312 | ·2375 | .. | .. | .. | Dumat. Matyar. | | | | | | | | | | | | |
| ,, .. | 510 | .. | 30 | ·1538 | .. | Matyar. | | | | | | | | | | | | |
| Mean, .. | 504 | ·2366 | .. | .. | ·80 | Mixed, | 580 | ·1953 | .. | .. | ·65 | Sandy, Dumat, | 1,120 | ·2421 | .. | .. | ·75 | Dumat. |
| ,, | 689 | .. | 42 | ·1985 | ·70 | .. | 960 | .. | 38 | ·2045 | ·72 | Dumat, Matyar, | 1,760 | .. | 45 | ·2003 | ·55 | .. |

TABLE E.—*Showing Mean Depths of Waterings per Crop, and District, and average interval between each Watering*—( contd.)

| District. | BARLEY. | | | | | | CARROTS. | | | | | | POTATOES. | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Length of water-course. | *Depth of Watering.* First. | Interval. | Second, &c. | Depth of damp. | Soil. | Length of water-course. | *Depth of Watering.* First. | Interval. | Second, &c. | Depth of damp. | Soil. | Length of water-course. | *Depth of Watering.* First. | Interval. | Second, &c. | Depth of damp. | Soil. |
| Cawnpore, .. | .. | .. | .. | .. | .. | .. | | | | | | | | | | | | |
| Hamirpur, .. | 140 | ·1380 | .. | .. | ·66 | Parwa. | | | | | | | | | | | | |
| Farukhabad, .. | 477 | ·1635 | .. | .. | .. | Dumat. | | | | | | | | | | | | |
| Mainpuri, .. | 1,207 | .. | 43 | ·2420 | ·72 | Dumat, Matyar, | 660 | .. | .. | ·1459 | ·60 | Matyar. Dumat. | | | | | | |
| ,, .. | .. | .. | .. | .. | .. | .. | | | | | | | | | | | | |
| Etah, .. | 780 | .. | 30 | ·1522 | ·50 | Dumat. | | | | | | | | | | | | |
| Aligarh, .. | 440 | .. | 43 | ·2043 | ·79 | ,, | 600 | .. | 20 | ·1509 | ·70 | Dumat. | | | | | | |
| Muttra, .. | 520 | ·2384 | .. | .. | ·90 | Sandy. | | | | | | | | | | | | |
| ,, .. | 550 | .. | 60 | ·1574 | 1·2 | .. | | | | | | | | | | | | |
| Bulandshahr, .. | .. | .. | .. | .. | .. | .. | | | | | | | | | | | | |
| ,, .. | .. | .. | .. | .. | .. | .. | | | | | | | | | | | | |
| Meerut, .. | 1,400 | .. | 60 | ·2491 | ·80 | .. | .. | .. | .. | .. | .. | .. | 640 | .. | 10 | ·0787 | ·75 | Matyar. |
| Muzaffarnagar, | .. | .. | .. | .. | .. | .. | | | | | | | | | | | | |
| Saháranpur, .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 500 | .. | 20 | ·0995 | ·80 | Dumat. |
| Bijnor, .. | .. | .. | .. | .. | .. | .. | | | | | | | | | | | | |
| Moradabad, .. | .. | .. | . | .. | .. | .. | | | | | | | | | | | | |
| Rampur, .. | .. | .. | .. | .. | .. | .. | | | | | | | | | | | | |
| Bareilly, .. | .. | .. | .. | .. | .. | .. | | | | | | | | | | | | |
| Pillibhit, .. | .. | .. | .. | .. | .. | .. | | | | | | | | | | | | |
| Shahjahanpur, .. | .. | . | .. | .. | .. | .. | | | | | | | | | | | | |
| Lucknow, .. | .. | .. | .. | .. | .. | .. | | | | | | | | | | | | |
| ,, .. | .. | .. | .. | .. | .. | .. | | | | | | | | | | | | |
| Hardui, .. | .. | .. | .. | .. | .. | .. | | | | | | | | | | | | |
| Mean, .. | 369 | ·1799 | .. | .. | ·78 | Mixed. | | | | | | | | | | | | |
| ,, .. | 675 | .. | 47 | ·2010 | ·80 | ,, | 630 | .. | 20 | ·1484 | ·65 | Mixed, | 570 | .. | 15 | ·0891 | ·77 | Mixed. |

TABLE E.—*Showing Mean Depths of Waterings per Crop and District, and average interval between each Watering.*—(contd.)

| District. | Garden Produce. | | | | | | Tobacco. | | | | | | Sugar. | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Length of water-course. | Depth of Watering. First. | Interval. | Second, &c. | Depth of damp. | Soil. | Length of water-course. | Depth of Watering. First. | Interval. | Second, &c. | Depth of damp. | Soil. | Length of water-course. | Depth of Watering. First. | Interval. | Second, &c. | Depth of damp. | Soil. |
| Cawnpore, .. | 100 | .. | 3 | ·0799 | .. | Dumat, | 215 | .. | 12 | ·1396 | ·72 | Dumat. | | | | | | |
| Hamirpur, .. | 350 | .. | .. | ·1359 | .. | Rakur, | 189 | .. | 20 | ·1508 | .. | Parwa. | | | | | | |
| Farukhabad, .. | 190 | .. | .. | ·1192 | .. | Matyar, | 350 | .. | 5 | ·1527 | ·73 | Dumat. | | | | | | |
| Mainpuri, .. | .. | .. | .. | .. | .. | .. | | | | | | | | | | | | |
| „ .. | .. | .. | .. | .. | .. | .. | | | | | | | | | | | | |
| Etah, .. | .. | .. | .. | .. | .. | .. | | | | | | | | | | | | |
| Aligarh, .. | 300 | .. | 6 | ·1179 | ·90 | Dumat. | | | | | | | | | | | | |
| Muttra, .. | .. | .. | .. | .. | .. | .. | | | | | | | | | | | | |
| „ .. | .. | .. | .. | .. | .. | .. | | | | | | | | | | | | |
| Bulandshahr, .. | 300 | ·2362 | .. | .. | 1·5 | .. | 607 | ·2086 | .. | .. | ·88 | Matyar. Dumat. | | | | | | |
| „ .. | 513 | .. | 25 | ·1725 | 1·4 | .. | 430 | .. | 5 | ·1181 | ·60 | Dumat. | | | | | | |
| Meerut, .. | .. | .. | .. | .. | .. | .. | | | | | | | | | | | | |
| Muzaffarnagar, | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 800 | ·2942 | .. | .. | 1·0 | Dumat. |
| Saháranpur, .. | 175 | .. | 8 | ·0968 | ·80 | Dumat. | | | | | | | | | | | | |
| Bijnor, .. | 80 | .. | .. | ·0468 | ·70 | Matyar, | .. | .. | .. | .. | .. | .. | 1357 | ·2530 | .. | .. | ·71 | .. |
| Moradabad, .. | .. | .. | .. | .. | .. | .. | 250 | .. | 4 | ·0696 | ·75 | .. | 427 | ·2557 | .. | .. | ·91 | Dumat. Sandy. |
| Rampur, .. | .. | .. | .. | .. | .. | .. | 100 | .. | 5 | ·0778 | ·66 | .. | | | | | | |
| Bareilly, .. | 160 | ·0840 | .. | .. | ·60 | Matyar, | 580 | .. | 7 | ·1389 | ·79 | .. | | | | | | |
| Pillibhit, .. | .. | .. | | .. | .. | .. | .. | .. | .. | .. | .. | .. | 230 | ·0527 | .. | .. | ·70 | Sandy. |
| Shahjahanpur, .. | 137 | .. | 4 | ·1193 | ·70 | .. | 265 | .. | 8 | ·1613 | ·85 | .. | 930 | 2742 | .. | .. | 1·0 | Dumat. |
| Lucknow, .. | Peas. 690 | .. | .. | ·0978 | .. | Dumat. | | | | | | | | | | | | |
| „ .. | .. | .. | .. | .. | .. | .. | | | | | | | | | | | | |
| Hardui, .. | Opium. 260 | ·1688 | .. | .. | .. | Dumat. Matyar. | | | | | | | | | | | | |
| Mean, .. | 240 | ·1297 | .. | .. | 1·0 | Mixed, | 607 | ·2086 | .. | .. | ·88 | Mixed. | 878 | ·2693 | .. | .. | ·90 | Sandy. Dumat. |
| „ .. | 282 | .. | 9 | ·1095 | 1·1 | .. | 297 | .. | 8 | ·1261 | ·73 | .. | | | | | | |

TABLE F—*Showing work done per head and daily duty per pair of Cattle or x number of men employed in* 19 *Districts of the N.-W. Provinces and Oudh.*

| District. | Number. | Class. | Labor. Class. | Labor. No. per lift. | Maximum depth to water surface. | Content of lift in cubic feet. | Percentage of work. Water. | Percentage of work. Dead weight. | Foot Tons per head per minute. Water. | Foot Tons per head per minute. Total. | Tons of water lifted per hour per head. | Duty per day of 9 hours. Depth ·1250. Area in acres. | Days to one acre. | Depth ·1860. Area in acres. | Days to one acre. | Depth ·2500. Area in acres. | Days to one acre. | Remarks. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cawnpore. | 18 | Lagor, | Cattle, | 2 | 94 | 1·875 | 79·0 | 21·0 | 1·090 | 1·360 | 0·70 | ·084 | 12 | ·0560 | 18 | ·042 | 24 | Well worked slowly for special reasons. |
| | 533 | „ | „ | 2 | 57 | 2·590 | 84·4 | 15·6 | 1·756 | 2·095 | 1·85 | ·2220 | 4·5 | ·1480 | 6·7 | ·1110 | 9 | |
| | 528 | „ | „ | 2 | 50 | 2·640 | 85·4 | 14·6 | 1·333 | 1·567 | 1·60 | ·1920 | 5·5 | ·1280 | 8·25 | ·0960 | 11 | |
| | 2 | „ | „ | 2·5 | 42 | 3·000 | 86·0 | 14·0 | 0·756 | 0·878 | 1·08 | ·1296 | 7·5 | ·0864 | 11·2 | ·0648 | 15 | |
| | 21 & 22 | „ | „ | 2 | 23 | 2·600 | 87·4 | 12·6 | 0·613 | 0·700 | 1·60 | ·1920 | 5·5 | ·1280 | 7·5 | ·0960 | 11 | |
| | 20 | „ | „ | 2 | 16 | 2·925 | 89·0 | 11·0 | 0·470 | 0·520 | 1·76 | ·2112 | 4·8 | ·1408 | 7·1 | ·1056 | 9·5 | |
| | Average, | „ | „ | 2 | 47 | 2·600 | 85·2 | 14·8 | 1·003 | 1·187 | 1·43 | ·1716 | 5·8 | ·1164 | 8·7 | ·0858 | 11·6 | 926 |
| Hamirpur. | 59 | „ | „ | 2 | 113 | 1·700 | 71·6 | 28·4 | 1·048 | 1·500 | 0·555 | ·0666 | 15 | ·0444 | 22·5 | ·0333 | 30 | |
| | 47 | „ | „ | 2 | 45 | 2·700 | 87·6 | 12·4 | 1·648 | 1·832 | 2·180 | ·2616 | 3·8 | ·1744 | 5·7 | ·1308 | 7·6 | |
| | 33 | „ | „ | 2 | 35 | 2·836 | 87·8 | 12·2 | 1·383 | 1·576 | 2·305 | ·2766 | 3·6 | ·1844 | 5·4 | ·1383 | 7·2 | |
| | 31 | „ | „ | 4 | 28 | 1·650 | 83·0 | 17·0 | 0·481 | 0·580 | 1·03 | ·1236 | 8·0 | ·0824 | 12·0 | 0618 | 16 | |
| | 32 | „ | „ | 2 | 27 | 2·4257 | 87·0 | 13·0 | 0·971 | 1·117 | 2·25 | ·2700 | 3·7 | ·1800 | 5·5 | ·1350 | 7·4 | |
| | 35 | „ | „ | 2 | 20 | 1·500 | 84·0 | 16·0 | 0·602 | 0·717 | 1·80 | ·2160 | 4·6 | ·1440 | 6·9 | ·1080 | 9·2 | |
| | 34 | „ | „ | 2 | 14 | 2·060 | 88·0 | 12·0 | 0·553 | 0·629 | 2·32 | ·2784 | 3·6 | ·1856 | 5·4 | ·1392 | 7·2 | |
| | Average, | „ | „ | 2 | 40 | 2·120 | 84·2 | 15·8 | 0·955 | 1·143 | 1·777 | ·2132 | 4·7 | ·1420 | 7·0 | ·1016 | 9·3 | 1152 |
| Farukhabad. | 63 | „ | „ | 2 | 61 | 3·150 | 86·4 | 13·6 | 1·013 | 1·160 | 1·000 | ·1200 | 8·3 | ·0800 | 12·4 | ·0600 | 16·6 | |
| | 66 | „ | „ | 2 | 60 | 2·950 | 86·0 | 14·0 | 1·073 | 1·250 | 1·02 | ·1224 | 8·2 | ·0816 | 12·2 | ·0612 | 16·3 | |
| | 90 | „ | „ | 2 | 59 | 4·800 | 88·2 | 11·8 | 2·516 | 2·860 | 2·55 | ·3060 | 3·3 | ·2040 | 81·9 | ·1530 | 6·5 | |
| | 88 | „ | „ | 2 | 56 | 5·740 | 89·5 | 10·5 | 1·547 | 1·728 | 1·666 | ·1998 | 5·0 | ·1332 | 7·5 | ·0999 | 10 | |
| | 72 | „ | „ | 2 | 50 | 3·600 | 88·3 | 11·7 | 1·327 | 1·509 | 1·60 | ·1920 | 5·5 | ·1280 | 8·25 | ·0960 | 11 | |
| | 69 | „ | „ | 2·5 | 46 | 2·700 | 85·3 | 14·7 | 0·725 | 0·854 | 1·04 | ·1248 | 8·0 | ·0832 | 12 | 0624 | 16 | |
| | 92 | „ | „ | 2 | 37 | 3·820 | 88·4 | 11·6 | 1·182 | 1·325 | 1·90 | ·2280 | 4·5 | ·1620 | 6·7 | ·1140 | 9 | |
| | 94 | „ | „ | 2 | 37 | 4·600 | 89·8 | 10·2 | 1·514 | 1·685 | 2·44 | ·2928 | 3·4 | ·1952 | 5·1 | ·1464 | 6·8 | |
| | 74 | „ | „ | 2 | 36 | 3·7125 | 90·7 | 9·3 | 1·433 | 1·580 | 2·50 | ·3000 | 3·3 | ·2000 | 5 | ·1500 | 6·6 | |
| | 78 | „ | „ | 2 | 34 | 3·375 | 89·8 | 10·2 | 1·010 | 1·125 | 1·76 | ·2112 | 4·8 | ·1308 | 7·1 | ·1056 | 9·5 | |
| | 87 | Dhenkli, | Men, | 1 | 16 | 0·4 | 100·0 | .. | 0·524 | 0·524 | 1·966 | ·1178 | 8·5 | ·0786 | 12·75 | ·0589 | 17 | Per man. |
| | 86 | „ | „ | 1 | 15 | 0·4 | 100·0 | .. | 0·447 | 0·447 | 1·78 | ·1068 | 9·9 | ·0712 | 14·1 | ·0534 | 18·7 | „ |
| | Average, | Lagor, | Cattle, | 2 | 47·6 | 3·84 | 88·2 | 11·8 | 1·334 | 1·507 | 1·75 | ·2100 | 4·8 | ·1400 | 7·1 | ·1050 | 9·5 | Per pair 1134 |
| | „ | Dhenkli, | Men, | 1 | 15·5 | 0·40 | 100·0 | .. | 0·485 | ·485 | 1·873 | ·1124 | 8·9 | ·0749 | 13·3 | ·0562 | 17·8 | Per man 607 |

NOTE.—To deduce total discharge in cubic feet per pair of cattle, multiply column "Tons of water lifted per hour per head" by 36 × 2 × 9 for a 9 hour working day. Average results thus calculated are shown in Remarks column.

TABLE F—*Showing work done per head and daily duty per pair of Cattle or x number of men employed in* 19 *Districts of the N.-W. Provinces and Oudh*—(Continued).

| District. | Number. | Class. | Labor. Class. | Labor. No. per lift. | Maximum depth to water surface. | Content of lift in cubic feet. | Percentage of work. Water. | Percentage of work. Dead weight. | Foot Tons per head per minute. Water. | Foot Tons per head per minute. Total. | Tons of water lifted per hour per head. | Duty per day of 9 hours. *Depth* ·1250. Area in acres. | *Depth* ·1250. Days to one acre. | *Depth* ·1860 Area in acres. | *Depth* ·1860 Days to one acre. | *Depth* ·2500. Area in acres. | *Depth* ·2500. Days to one acre. | Remarks. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Mainpuri. | 153 | Kili, | Cattle, | 4·5 | 31 | 4·670 | 90·5 | 9·5 | 0·894 | 0·988 | 1·72 | ·2064 | 4·9 | ·1376 | 7·3 | ·1032 | 9·7 | |
| | 147 | Lagor, | „ | 2 | 29 | 3·4875 | 89·1 | 10·9 | 0·986 | 1·107 | 2·04 | ·2448 | 4·1 | ·1632 | 6·2 | ·1224 | 8·2 | |
| | 150 | Kili, | „ | 6 | 28 | 5·2875 | 90·5 | 9·5 | 0·498 | 0·550 | 1·07 | ·1284 | 7·8 | ·0856 | 11·7 | ·0642 | 15·6 | |
| | 100 | Lagor, | „ | 2 | 27 | 3·1725 | 88·0 | 12·0 | 0·726 | 0·827 | 1·60 | ·1920 | 5·2 | ·1280 | 8·4 | ·0960 | 10·4 | |
| | 123 | „ | „ | 3 | 26 | 3·015 | 87·7 | 12·3 | 0·691 | 0·787 | 1·60 | ·1920 | 5·2 | ·1280 | 8·4 | ·0960 | 10·4 | |
| | 143 | „ | „ | 2 | 24·5 | 4·725 | 90·8 | 9·2 | 1·251 | 1·388 | 3·081 | ·3696 | 2·7 | ·2464 | 4·0 | ·1848 | 5·4 | |
| | 96 | „ | „ | 2 | 24 | 2·8125 | 89·0 | 11·0 | 0·366 | 0·411 | 0·985 | ·1182 | 8·5 | ·0788 | 12·7 | ·0591 | 16·9 | |
| | 110 | „ | „ | 4 | 23 | 2·540 | 87·9 | 12·1 | 0·352 | 0·400 | 0·810 | ·0972 | 10·3 | ·0648 | 15·4 | ·0486 | 20·5 | |
| | 140 | „ | „ | 2 | 23 | 4·160 | 89·8 | 10·2 | 1·172 | 1·302 | 3·081 | ·3696 | 2·7 | ·2464 | 4·0 | ·1848 | 5·4 | |
| | 173 | „ | „ | 2 | 22 | 2·700 | 88·7 | 11·3 | 0·472 | 0·533 | 1·28 | ·1536 | 6·5 | ·1024 | 9·75 | ·0768 | 13·0 | |
| | 138 | „ | „ | 2 | 21 | 4·106 | 89·9 | 10·1 | 1·242 | 1·380 | 3·54 | ·4248 | 2·4 | ·2832 | 3·5 | ·2124 | 4·7 | |
| | 117 | „ | „ | 2·25 | 20 | 3·150 | 87·0 | 13·0 | 0·671 | 0·771 | 2·04 | ·2448 | 4·1 | ·1632 | 6·2 | ·1224 | 8·2 | |
| | 120 | „ | „ | 2 | 20·5 | 2·950 | 87·8 | 12·2 | 0·786 | 0·892 | 2·30 | ·2760 | 3·6 | ·1840 | 5·4 | ·1380 | 7·2 | |
| | 141 | „ | „ | 2 | 19 | 4·050 | 89·9 | 10·1 | 0·809 | 0·900 | 2·53 | ·3036 | 3·3 | ·2024 | 5·0 | ·1518 | 6·6 | |
| | 113 | „ | „ | 2 | 18 | 2·700 | 88·7 | 11·3 | 0·537 | 0·605 | 1·80 | ·2160 | 4·7 | ·1440 | 7·0 | ·1080 | 9·3 | |
| | 128 | „ | „ | 2 | 18 | 3·094 | 88·8 | 11·2 | 0·536 | 0·612 | 1·80 | ·2160 | 4·7 | ·1440 | 7·0 | ·1080 | 9·3 | |
| | 136 | „ | „ | 2 | 18 | 4·050 | 90·0 | 10·0 | 0·786 | 0·873 | 2·60 | ·3120 | 3·2 | ·2080 | 4·8 | ·1560 | 6·4 | |
| | 106 | „ | „ | 2 | 17 | 2·925 | 88·5 | 11·5 | 0·484 | 0·546 | 1·71 | ·2052 | 4·9 | ·1368 | 9·4 | ·1026 | 9·8 | |
| | 131 | „ | „ | 2 | 17 | 4·050 | 90·0 | 10·0 | 1·080 | 1·200 | 3·80 | ·4560 | 2·2 | ·3040 | 3·3 | ·2280 | 4·4 | |
| | 155 | „ | „ | 2 | 17 | 3·375 | 89·7 | 10·3 | 0·628 | 0·700 | 2·18 | ·2616 | 3·8 | ·1744 | 5·7 | ·1308 | 7·6 | |
| | 160 | „ | „ | 2·34 | 16 | 2·7832 | 90·6 | 9·4 | 0·346 | 0·381 | 1·314 | ·1576 | 6·4 | ·1051 | 9·5 | ·0788 | 12·7 | |
| | 166 | „ | „ | 2 | 15 | 3·2625 | 90·0 | 10·0 | 0·441 | 0·489 | 1·77 | ·2124 | 4·7 | ·1416 | 7·0 | ·1062 | 9·4 | |
| | 167 | „ | „ | 2·34 | 15 | 3·2715 | 90·0 | 10·0 | 0·343 | 0·381 | 1·40 | ·1680 | 5·9 | ·1120 | 9·0 | ·0840 | 11·9 | |
| | 170 | „ | „ | 2 | 12·3 | 3·262 | 89·9 | 10·1 | 0·317 | 0·352 | 1·52 | ·1824 | 5·4 | ·1216 | 8·2 | ·0912 | 10·9 | |
| | 133 | „ | „ | 2 | 12 | 3·490 | 90·2 | 9·8 | 0·502 | 0·556 | 2·55 | ·3060 | 3·3 | ·2040 | 4·9 | ·1530 | 6·5 | |
| | Average, | „ | „ | 2 | 20 | 3·790 | 89·3 | 10·7 | 0·675 | 0·756 | 2·057 | ·2468 | 4·2 | ·1645 | 6·2 | ·1234 | 8·3 | 1333 |
| | „ | Kili, | „ | 5 | 30 | 5·000 | 90·5 | 9·5 | 0·696 | 0·769 | 1·395 | ·1674 | 6·0 | ·1116 | 8·9 | ·0837 | 11·9 | 904 |
| Etah. | 188 | Lagor, | „ | 2 | 22·8 | 2·770 | 89·6 | 10·4 | 0·587 | 0·655 | 1·52 | ·1824 | 5·4 | ·1216 | 8·2 | ·0912 | 10·9 | |
| | 189 | Kili, | „ | 4 | 22·8 | 5·030 | 90·6 | 9·4 | 0·793 | 0·875 | 2·10 | ·2520 | 3·9 | ·1680 | 5·8 | ·1260 | 7·9 | |

TABLE F—*Showing work done per head and daily duty per pair of Cattle or x number of men employed in* 19 *Districts of the N.-W. Provinces and Oudh*—(Continued.)

| District. | Number. | Class. | Labor. Class. | Labor. No. per lift. | Maximum depth to water surface. | Content of lift in cubic feet. | Percentage of work. Water. | Percentage of work. Dead weight. | Foot Tons per head per minute. Water. | Foot Tons per head per minute. Total. | Tons of water lifted per hour per head. | Duty per day of 9 hours. *Depth* ·1250. Area in acres. | *Depth* ·1250. Days to one acre. | *Depth* ·1860. Area in acres. | *Depth* ·1860. Days to one acre. | *Depth* ·2500. Area in acres. | *Depth* ·2500. Days to one acre. | Remarks. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ETAH—*Continued.* | 192 | Lagor, | Cattle, | 2 | 22·6 | 2·880 | 89·3 | 10·7 | 0·786 | 0·880 | 2·10 | ·2520 | 3·9 | ·1680 | 5·8 | ·1260 | 7·9 | |
| | 196 | Kili, | ,, | 2 | 21·5 | 5·5125 | 91·0 | 9·0 | 1·337 | 1·469 | 3·736 | ·4482 | 2·3 | ·2988 | 3·4 | ·2241 | 4·5 | |
| | 178 | Lagor, | ,, | 2 | 16·0 | 2·860 | 90·0 | 10·0 | 0·394 | 0·438 | 1·47 | ·1764 | 5·5 | ·1176 | 8·2 | ·0882 | 11·0 | |
| | 180 | ,, | ,, | 2 | 14·0 | 2·475 | 89·8 | 10·2 | 0·353 | 0·392 | 1·48 | ·1764 | 5·5 | ·1184 | 8·2 | ·0882 | 11·0 | |
| | 183 | ,, | ,, | 2 | 13·4 | 2·620 | 89·5 | 10·5 | 0·342 | 0·380 | 1·555 | ·1866 | 5·4 | ·1244 | 8·0 | ·0933 | 10·7 | |
| | Average, | ,, | ,, | 2 | 17·76 | 2·720 | 89·6 | 10·4 | 0·492 | 0·569 | 1·625 | ·1950 | 5·1 | ·1300 | 7·7 | ·0975 | 10·2 | 1053 |
| | ,, | Kili, | ,, | 3 | 22·0 | 5·270 | 90·8 | 9·2 | 1·066 | 1·122 | 2·918 | ·3500 | 2·85 | ·2334 | 4·3 | ·1750 | 5·7 | 1890 |
| | 255 | ,, | ,, | 2 | 51 | 6·750 | 90·4 | 9·6 | 2·326 | 2·574 | 2·72 | ·3264 | 3·1 | ·2176 | 4·6 | ·1632 | 6·1 | |
| | 257 | ,, | ,, | 2 | 51 | 6·240 | 89·7 | 10·3 | 1·993 | 2·223 | 2·33 | ·2796 | 3·6 | ·1864 | 5·3 | ·1398 | 7·1 | |
| | 251 | ,, | ,, | 4 | 40 | 7·140 | 90·2 | 9·8 | 1·327 | 1·471 | 2·01 | ·2412 | 4·2 | ·1608 | 6·2 | ·1206 | 8·3 | |
| | 265 | ,, | ,, | 4 | 40 | 6·200 | 90·3 | 9·7 | 1·083 | 1·200 | 1·61 | ·1932 | 5·2 | ·1288 | 7·7 | ·0966 | 10·3 | |
| | 259 | ,, | ,, | 4 | 36 | 6·1425 | 90·4 | 9·6 | 1·035 | 1·145 | 1·68 | ·2016 | 5·0 | ·1344 | 7·5 | ·1008 | 10·0 | |
| | 275 | ,, | ,, | 4 | 36 | 5·7375 | 90·4 | 9·6 | 1·248 | 1·380 | 2·08 | ·2496 | 4·0 | ·1664 | 6·0 | ·1248 | 8·0 | |
| | 242 | ,, | ,, | 4 | 31 | 6·860 | 91·5 | 8·5 | 0·915 | 1·000 | 1·76 | ·2012 | 4·8 | ·1408 | 6·8 | ·1056 | 9·5 | |
| | 268 | ,, | ,, | 2 | 29 | 5·740 | 91·0 | 9·0 | 1·568 | 1·722 | 3·236 | ·3880 | 2·6 | ·2588 | 3·9 | ·1940 | 5·2 | |
| | 269 | ,, | ,, | 2 | 29 | 6·270 | 91·0 | 9·0 | 1·820 | 2·000 | 3·75 | ·4500 | 2·2 | ·3000 | 3·3 | ·2250 | 4·4 | |
| | 239 | ,, | ,, | 2 | 28 | 5·500 | 90·7 | 9·3 | 1·154 | 1·273 | 2·50 | ·3000 | 3·9 | ·2000 | 5·0 | ·1500 | 6·7 | |
| | 229 231 | ,, | ,, | 4 | 24 | 6·6375 | 91·5 | 8·5 | 0·789 | 0·861 | 1·958 | ·2548 | 3·9 | ·1566 | 5·9 | ·1274 | 7·8 | |
| | 207 | ,, | ,, | 6 | 21 | 5·5125 | 91·3 | 8·7 | 1·004 | 1·103 | 2·875 | ·3450 | 2·8 | ·2300 | 4·2 | ·1725 | 5·6 | |
| | 221 | ,, | ,, | 2 | 20 | 6·6375 | 91·8 | 8·2 | 1·888 | 2·052 | 5·625 | ·6750 | 1·5 | ·4500 | 2·25 | ·3375 | 3·0 | |
| | 234 | ,, | ,, | 2 | 20 | 6·750 | 92·0 | 8·0 | 1·295 | 1·407 | 3·875 | ·4650 | 2·2 | ·3100 | 3·2 | ·2325 | 4·3 | |
| | 235 | ,, | ,, | 2 | 20 | 4·6125 | 91·0 | 9·0 | 0·834 | 0·916 | 2·50 | ·3000 | 3·9 | ·2000 | 5·0 | ·1500 | 6·7 | |
| | 217 | ,, | ,, | 6 | 19·6 | 7·0875 | 92·3 | 7·7 | 0·672 | 0·727 | 2·055 | ·2466 | 4·1 | ·1644 | 6·1 | ·1233 | 8·1 | |
| | 218 | ,, | ,, | 6 | 19·6 | 6·750 | 92·3 | 7·7 | 0·736 | 0·800 | 2·222 | ·2666 | 3·8 | ·1777 | 5·6 | ·1333 | 7·5 | |
| | 203 | ,, | ,, | 4 | 18 | 5·0625 | 90·8 | 9·2 | 0·558 | 0·612 | 1·85 | ·2220 | 4·5 | ·1480 | 6·8 | ·1110 | 9·0 | |
| | 211 | ,, | ,, | 3 | 11·5 | 5·7937 | 92·4 | 7·6 | 0·879 | 0·955 | 3·19 | ·3828 | 2·6 | ·2552 | 3·9 | ·1914 | 5·2 | |
| | 200 | ,, | ,, | 4 | 12 | 5·625 | 92·0 | 8·0 | 0·322 | 0·350 | 1·60 | ·1920 | 5·2 | ·1280 | 7·7 | ·0960 | 10·3 | |
| ALIGARH. | Average, | ,, | ,, | 3·5 | 28·8 | 6·150 | 91·1 | 8·9 | 1·172 | 1·293 | 1·5713 | ·3084 | 3·25 | ·2057 | 4·9 | 1542 | 6·5 | 1018 |

TABLE F—*Showing work done per head and daily duty per pair of Cattle or x number of men employed in 19 Districts of the N.-W. Provinces and Oudh*—(Continued.)

| District. | Number. | Class. | Labor. Class. | Labor. No. per lift. | Maximum depth to water surface. | Content of lift in cubic feet. | Percentage of work. Water. | Percentage of work. Dead weight. | Foot Tons per head per minute. Water. | Foot Tons per head per minute. Total. | Tons of water lifted per hour per head. | Duty per day of 9 hours. *Depth* 1250. Area in acres. | Days to one acre. | *Depth* 1860. Area in acres. | Days to one acre. | *Depth* 2500. Area in acres. | Days to one acre. | Remarks. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Muttra. | 307 | Kili, | Cattle, | 4 | 69 | 6·1875 | 89·0 | 11·0 | 1·941 | 2·188 | 1·700 | ·2040 | 4·9 | ·1360 | 7·4 | ·1020 | 9·8 | |
| | 309 | „ | „ | 4 | 69 | 5·400 | 88·3 | 11·7 | 1·174 | 1·330 | 1·020 | ·1224 | 8·2 | ·0816 | 12·2 | ·0612 | 16·3 | |
| | 300 | Lagor, | „ | 2 | 65 | 4·220 | 87·0 | 13·0 | 1·542 | 1·773 | 1·416 | ·1698 | 5·9 | ·1132 | 8·9 | ·0849 | 11·8 | |
| | 319 | Kili, | „ | 2 | 62 | 5·400 | 88·6 | 11·4 | 1·772 | 2·000 | 1·700 | ·2040 | 4·9 | ·1360 | 7·4 | ·1020 | 9·8 | |
| | 325 | „ | „ | 2 | 62 | 4·890 | 88·6 | 11·4 | 2·022 | 2·283 | 1·944 | ·2532 | 3·9 | ·1555 | 6·0 | ·1266 | 7·9 | |
| | 315 | „ | „ | 4 | 61 | 6·1875 | 89·2 | 10·8 | 1·446 | 1·622 | 1·416 | ·1698 | 5·9 | ·1132 | 8·9 | ·0849 | 11·8 | |
| | 312 | „ | „ | 2 | 60 | 4·950 | 88·0 | 12·0 | 1·822 | 2·070 | 1·736 | ·2082 | 4·8 | ·1388 | 7·2 | ·1041 | 9·6 | |
| | 287 | „ | „ | 2 | 53 | 7·650 | 91·4 | 8·6 | 2·382 | 2·607 | 2·680 | ·3216 | 3·1 | ·2144 | 4·7 | ·1608 | 6·2 | |
| | 291 | „ | „ | 2 | 52 | 4·725 | 89·0 | 11·0 | 2·443 | 2·746 | 2·806 | ·3366 | 2·9 | ·2244 | 4·4 | ·1683 | 5·9 | |
| | Average, | Lagor, | „ | 2 | 65 | 4·220 | 87·0 | 13·0 | 1·542 | 1·773 | 1·476 | ·1698 | 5·9 | ·1132 | 8·9 | ·0849 | 11·8 | 956 |
| | „ | Kili, | „ | 3 | 61 | 5·670 | 89·0 | 11·0 | 1·875 | 2·106 | 1·875 | ·2450 | 4·1 | ·1500 | 6·7 | ·1225 | 8·2 | 1215 |
| Bulandshahr. | 374 | „ | „ | 4 | 33 | 3·740 | 89·3 | 10·7 | 0·696 | 0·780 | 1·280 | ·1536 | 6·5 | ·1024 | 9·8 | ·0768 | 13·0 | |
| | 389 | „ | „ | 4 | 30 | 5·290 | 90·3 | 9·7 | 0·700 | 0·775 | 1·400 | ·1680 | 5·9 | ·1120 | 8·8 | ·0840 | 11·9 | |
| | 369 | „ | „ | 4 | 28 | 5·740 | 90·7 | 9·3 | 1·097 | 1·153 | 2·250 | ·2700 | 3·7 | ·1800 | 5·6 | ·1350 | 7·4 | |
| | 359 | „ | „ | 4 | 27 | 5·570 | 91·0 | 9·0 | 0·546 | 0·600 | 1·139 | ·1366 | 7·3 | ·0911 | 11·0 | ·0683 | 14·6 | |
| | 346 | „ | „ | 4 | 26 | 6·000 | 91·0 | 9·0 | 1·156 | 1·271 | 2·639 | ·3166 | 3·2 | ·2111 | 4·7 | ·1583 | 6·3 | |
| | 381 | „ | „ | 4 | 21·7 | 5·740 | 91·5 | 8·5 | 0·818 | 0·894 | 2·280 | ·2736 | 3·7 | ·1824 | 5·5 | ·1368 | 7·3 | |
| | 386 | „ | „ | 4 | 19·5 | 5·340 | 91·0 | 9·0 | 0·883 | 0·970 | 2·722 | ·3266 | 3·1 | ·2177 | 4·6 | ·1633 | 6·1 | |
| | 400 | „ | „ | 4 | 18 | 5·625 | 91·5 | 8·5 | 0·780 | 0·853 | 2·583 | ·3098 | 3·3 | ·2066 | 4·9 | ·1549 | 6·5 | |
| | 394 | „ | „ | 4 | 16 | 6·525 | 92·0 | 8·0 | 0·894 | 0·972 | 3·333 | ·3996 | 2·5 | ·2666 | 3·8 | ·1998 | 5·0 | |
| | Average, | „ | „ | 4 | 24·3 | 5·510 | 90·9 | 9·1 | 0·841 | 0·919 | 2·181 | ·2616 | 3·8 | ·1744 | 5·7 | ·1308 | 7·6 | 1414 |
| Meerut. | 435 434 436 | „ | „ | 4 | 33·5 | 5·000 | 89·5 | 10·5 | 1·234 | 1·378 | 2·200 | ·2640 | 3·8 | ·1760 | 5·6 | ·1320 | 7·5 | |
| | 436 | „ | „ | 4 | 33·5 | 4·050 | 89·2 | 10·8 | 1·322 | 1·482 | 2·360 | ·2832 | 3·5 | ·1888 | 5·3 | ·1416 | 7·0 | |
| | 430 | „ | „ | 4 | 28 | 5·340 | 90·5 | 9·5 | 1·176 | 1·300 | 2·500 | ·3000 | 3·9 | ·2000 | 5·0 | ·1500 | 6·7 | |
| | 434 | „ | „ | 4 | 28 | 5·000 | 90·0 | 10·0 | 0·963 | 1·070 | 2·080 | ·2496 | 4·1 | ·1664 | 6·1 | ·1248 | 8·1 | |
| | 425 | „ | „ | 4 | 27·5 | 5·230 | 90·3 | 9·7 | 1·003 | 1·111 | 2·180 | ·2616 | 3·8 | ·1844 | 5·7 | ·1308 | 7·6 | |
| | 412 410 414 | „ | „ | 4 | 26·4 | 5·7375 | 91·2 | 8·8 | 1·108 | 1·327 | 2·730 | ·3276 | 3·1 | ·2184 | 4·6 | ·1638 | 6·1 | |
| | 406 | „ | „ | 4 | 24·6 | 5·9625 | 91·6 | 8·4 | 1·209 | 1·418 | 3·170 | ·3804 | 2·7 | ·2536 | 4·0 | ·1902 | 5·3 | |
| | 439 441 | „ | „ | 4 | 24·0 | 5·850 | 90·6 | 9·4 | 0·815 | 0·904 | 2·040 | ·2448 | 4·1 | ·1632 | 6·1 | ·1224 | 8·2 | |
| | | „ | „ | 4 | 19·4 | 6·640 | 92·0 | 8·0 | 0·870 | 0·946 | 2·680 | ·3216 | 3·1 | ·2144 | 4·7 | ·1608 | 6·2 | |
| | | „ | „ | 4 | 19·4 | 6·640 | 92·0 | 8·0 | 0·870 | 0·947 | 2·680 | ·3216 | 3·1 | ·2144 | 4·7 | ·1608 | 6·2 | |

TABLE F—*Showing work done per head and daily duty per pair of cattle or x number of men employed in* 19 *Districts of the N.-W. Provinces and Oudh*—(Continued.)

| District. | Number. | Class. | Labor. Class. | Labor. No. per lift. | Maximum depth to water surface. | Content of lift in cubic feet. | Percentage of work. Water. | Percentage of work. Dead weight. | Foot Tons per head per minute. Water. | Foot Tons per head per minute. Total. | Tons of water lifted per hour per head. | Duty per day of 9 hours. *Depth* ·1250. Area in acres. | *Depth* ·1250. Days to one acre. | *Depth* ·1860. Area in acres. | *Depth* ·1860. Days to one acre. | *Depth* ·2500. Area in acres. | *Depth* ·2500. Days to one acres. | Remarks. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Average, | Kili, | Cattle, | 4 | 26·43 | 5·540 | 90·7 | 9·3 | 1·066 | 1·188 | 2·462 | ·2954 | 3·4 | ·1969 | 5·1 | ·1477 | 6·8 | 1596 |
| Saharanpur Muzaffarnagar. | 444 | „ | „ | 8 | 18·8 | 4·500 | 90·8 | 9·2 | 0·572 | 0·630 | 1·800 | ·2160 | 4·6 | ·1440 | 6·9 | ·1080 | 9·2 | 1166 |
| | 451 | Lagor, | „ | 4 | 26 | 3·4875 | 89·1 | 10·9 | 0·686 | 0·770 | 1·600 | ·1920 | 5·2 | ·1280 | 7·8 | ·0960 | 10·4 | |
| | 449 | „ | „ | 2 | 20 | 2·360 | 87·5 | 12·5 | 0·848 | 0·970 | 2·540 | ·3048 | 3·3 | ·2032 | 5·0 | ·1524 | 6·6 | |
| | Average, | „ | „ | 3 | 23 | 2·920 | 88·3 | 11·2 | 0·767 | 0·870 | 2·070 | ·2484 | 4·0 | ·1656 | 6·0 | ·1242 | 8·0 | 1341 |
| Bijnor. | 461 | Dhenkli, | Men, | 1 | 21 | 0·253 | 100·0 | .. | 0·400 | 0·400 | 1·111 | ·0666 | 15 | ·0444 | 22·5 | ·0333 | 30 | Per man. |
| | 463 | „ | „ | 1 | 21 | 0·200 | 100·0 | .. | 0·300 | 0·300 | 0·861 | ·0516 | 19·8 | ·0344 | 29·0 | ·0258 | 38·7 | „ „ |
| | 467 | Kili, | Cattle, | 8 | 20 | 3·480 | 89·7 | 10·3 | 0·450 | 0·502 | 1·400 | ·1680 | 6·0 | ·1120 | 8·9 | ·0840 | 11·9 | Per pair. |
| | 465 | „ | „ | 8 | 18 | 2·760 | 89·3 | 10·7 | 0·323 | 0·362 | 1·080 | ·1296 | 7·7 | ·0864 | 11·6 | ·0648 | 15·4 | |
| | 469 | „ | „ | 8 | 17 | 3·7125 | 91·0 | 9·0 | 0·347 | 0·382 | 1·222 | ·1466 | 6·8 | ·0977 | 10·2 | ·0733 | 13·6 | |
| | Average, | Dhenkli, | Men, | 1 | 21 | 0·226 | 100·0 | .. | 0·350 | 0·350 | 0·986 | ·0590 | 16·9 | ·0394 | 25·4 | ·0295 | 33·9 | Per man, 360 |
| | „ | Kili, | Cattle, | 8 | 18·3 | 3·320 | 90·0 | 10·0 | 0·374 | 0·411 | 1·234 | ·1480 | 6·8 | ·0987 | 10·2 | ·0740 | 13·5 | Per pair, 800 |
| Moradabad. | 478 | „ | „ | 4 | 21 | 4·000 | 89·6 | 10·4 | 0·557 | 0·622 | 1·555 | ·1866 | 5·4 | ·1244 | 8·0 | ·0933 | 10·7 | |
| | 471 | „ | „ | 4 | 19 | 2·820 | 89·4 | 10·6 | 0·426 | 0·484 | 1·361 | ·1632 | 6·1 | ·1088 | 9·2 | ·0816 | 12·2 | |
| | 472 | „ | „ | 4 | 19 | 3·440 | 89·6 | 10·4 | 0·464 | 0·518 | 1·460 | ·1752 | 5·7 | ·1168 | 8·6 | ·0876 | 11·4 | |
| | 476 | „ | „ | 2 | 19 | 4·500 | 91·0 | 9·0 | 1·041 | 1·144 | 3·333 | ·3998 | 2·5 | ·2666 | 3·8 | ·1999 | 5·0 | |
| | 484 | Dhenkli, | Men, | 1 | 19 | 0·27562[illegible] | 100·0 | .. | 0·565 | 0·565 | 1·722 | ·1032 | 9·7 | ·0688 | 14·6 | ·0516 | 19·4 | Per man. |
| | 480 | „ | „ | 1 | 10·5 | 0·230625 | 100·0 | .. | 0·371 | 0·371 | 1·750 | ·1050 | 9·7 | ·0700 | 14·5 | ·0525 | 19·3 | „ „ |
| | 481 | „ | „ | 1 | 10·5 | 0·30375 | 100·0 | | | 0·371 | 2·444 | ·1466 | 6·8 | ·0977 | 10·2 | ·0733 | 13·6 | „ „ |
| | Average, | „ | „ | 1 | 13·3 | 0·273 | 100·0 | .. | 0·436 | 0·436 | 1·972 | ·1182 | 8·5 | ·0788 | 12·7 | ·0591 | 16·9 | „ „ 639 |
| | „ | Kili, | Cattle, | 3·5 | 19·5 | 3·690 | 89·9 | 10·1 | 0·622 | 0·692 | 1·927 | ·2312 | 4·3 | ·1541 | 65 | ·1156 | 8·6 | Per pair 1249 |
| Rampur. | 488 | Ráti, | Men, | 1 | 22 | 0·319 | 100·0 | .. | 0·615 | 0·615 | 1·666 | ·0998 | 10·0 | ·0666 | 15 | ·0499 | 20·0 | Per man, 540 |
| Bareilly. | 491 490 | Kili, | Cattle, | 2 | 42 | 4·3875 | 88·2 | 11·8 | 2·077 | 2·355 | 2·916 | ·3498 | 2·9 | ·2332 | 4·3 | ·1749 | 5·7 | Per pair. |
| | 492 | „ | „ | 2 | 42 | 5·340 | 89·7 | 10·3 | 2·749 | 3·064 | 3·900 | ·4680 | 2·2 | ·3120 | 3·2 | ·2340 | 4·3 | |
| | 494 | „ | „ | 2 | 42 | 4·050 | 88·0 | 12·0 | 1·460 | 1·660 | 2·055 | ·2466 | 4·1 | ·1644 | 6·1 | ·1233 | 8·1 | |
| | 490 | „ | „ | 2 | 39 | 5·625 | 91·6 | 8·4 | 2·020 | 2·206 | 3·111 | ·2932 | 2·7 | ·2488 | 4·0 | ·1866 | 5·3 | |
| | 497 | Ráti, | Men, | 1 | 10 | 0·400 | 100·0 | .. | 0·390 | 0·390 | 2·330 | ·1398 | 7·2 | ·0932 | 10·7 | ·0699 | 14·3 | Per man, 755 |
| Pillibit. | Average, | Kili, | Cattle, | 2 | 41 | 4·85 | 89·4 | 10·6 | 2·076 | 2·321 | 2·996 | ·3594 | 2·8 | ·2396 | 4·2 | ·1797 | 5·6 | Per pair, 1941 |
| | 501 | Dhenkli, | Men, | 3 | 17 | 0·400 | 100·0 | .. | 0·100 | ·100 | 0·350 | ·0210 | 47·6 | ·0140 | 71·4 | ·0105 | 95·2 | Per man worked slowly, 113 |

TABLE F—*Showing work done per head and daily duty per pair of Cattle or x number of men employed in* 19 *Districts of the N.-W. Provinces and Oudh*—(Continued.)

| District. | Number. | Class. | Labor. Class. | Labor. No. per lift. | Maximum depth to water surface. | Content of lift in cubic feet. | Percentage of work. Water. | Percentage of work. Dead weight. | Foot Tons per head per minute. Water. | Foot Tons per head per minute. Total. | Tons of water lifted per hour per head. | Duty per day of 9 hours. *Depth* ·1250. Area in acres. | Duty per day of 9 hours. *Depth* ·1250. Days to one acre. | Duty per day of 9 hours. *Depth* ·1860. Area in acres. | Duty per day of 9 hours. *Depth* ·1860. Days to one acre. | Duty per day of 9 hours. *Depth* ·2500. Area in acres. | Duty per day of 9 hours. *Depth* ·2500. Days to one acre. | Remarks. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Shahjahanpur. | 517 | Lagor, | Cattle, | 2 | 35 | 4·000 | 88·4 | 11·6 | 1·603 | 1·814 | 2·736 | ·3282 | 3·1 | ·2188 | 4·6 | ·1641 | 6·1 | Per pair. | |
| | 514 | „ | „ | 2 | 34 | 4·050 | 88·7 | 11·3 | 1·653 | 1·864 | 2·900 | ·3480 | 2·9 | ·2320 | 4·3 | ·1740 | 5·7 | „ „ | |
| | 505 | „ | Men, | 6 | 31 | 1·630 | 88·3 | 16·4 | 0·407 | 0·487 | 0·806 | ·0966 | 10·1 | ·0644 | 15·1 | ·0483 | 20·1 | „ „ | |
| | 522 | Ráti, | „ | 1 | 25 | 0·400 | 100·0 | .. | 1·020 | 1·020 | 2·472 | ·1524 | 6·6 | ·0988 | 9·8 | ·0762 | 13·1 | Per man. | |
| | 524<br>526 | „ | „ | 1 | 25 | 0·400 | 100·0 | .. | 0·785 | 0·785 | 1·900 | ·1140 | 8·8 | ·0760 | 13·1 | ·0570 | 17·5 | „ „ | |
| | 520 | Dhenkli, | „ | 1 | 14 | 0·400 | 100·0 | .. | 0·320 | 0·320 | 1·333 | ·0798 | 12·7 | ·0533 | 19·1 | ·0399 | 25·4 | „ „ | |
| | Average, | Ráti, | „ | 1 | 25 | 0·400 | 100·0 | .. | 0·902 | 0·902 | 2·186 | ·1310 | 7·7 | ·0874 | 11·5 | ·0655 | 15·3 | „ „ | 709 |
| | „ | Lagor, | „ | 6 | 31 | 1·630 | 83·6 | 16·4 | 0·407 | 0·487 | 0·806 | ·0966 | 10·1 | ·0644 | 15·1 | ·0483 | 20·1 | Per pair, | 522 |
| | „ | „ | Cattle, | 2 | 34·5 | 4·025 | 88·5 | 11·5 | 1·628 | 1·839 | 2·818 | ·3380 | 2·9 | ·2254 | 4·4 | ·1690 | 5·9 | „ „ | 1826 |
| Lucknow. | 581 | „ | Men, | 6 | 35 | 1·500 | 81·8 | 18·2 | 0·399 | 0·488 | 0·675 | ·0810 | 12·4 | ·0540 | 18·5 | ·0405 | 24·7 | Per pair. | |
| | 578 | „ | Cattle, | 4 | 34 | 2·250 | 85·1 | 14·9 | 0·491 | 0·584 | 0·875 | ·1050 | 9·5 | ·0700 | 14·3 | ·0525 | 19·0 | „ „ | |
| | 586 | „ | „ | 3 | 34 | 1·068 | 78·3 | 21·7 | 0·259 | 0·331 | 0·460 | ·0552 | 18·1 | ·0368 | 27·2 | ·0276 | 36·2 | | |
| | 584 | „ | „ | 4 | 31 | 2·070 | 84·4 | 15·6 | 0·396 | 0·470 | 0·764 | ·0916 | 10·9 | ·0610 | 16·4 | ·0458 | 21·8 | | |
| | 555 | „ | Men, | 6 | 30 | 1·4625 | 82·0 | 18·0 | 0·387 | 0·472 | 0·777 | ·0932 | 10·8 | ·0611 | 16·2 | ·0466 | 21·6 | | |
| | 522 | „ | Cattle, | 3 | 24 | 2·025 | 85·1 | 14·9 | 0·421 | 0·495 | 1·111 | ·1332 | 7·5 | ·0888 | 11·3 | ·0666 | 15·0 | | |
| | 568 | „ | Men, | 8 | 17 | 2·585 | 89·0 | 11·0 | 0·392 | 0·440 | 1·377 | ·1652 | 6·1 | ·1101 | 9·1 | ·0826 | 12·1 | | |
| | Average, | „ | Cattle, | 3·5 | 31 | 1·85 | 83·2 | 16·8 | 0·392 | 0·470 | 0·802 | ·0962 | 10·1 | ·0641 | 15·1 | ·0481 | 20·1 | | 519 |
| | „ | „ | Men, | 7 | 27·3 | 1·84 | 84·3 | 15·7 | 0·392 | 0·467 | 0·943 | ·1130 | 8·85 | ·0754 | 13·3 | ·0565 | 17·7 | | 611 |
| Hardui. | 590 | „ | „ | 7 | 38 | 2·250 | 84·6 | 15·4 | 0·403 | 0·477 | 0·639 | ·0766 | 13·1 | ·0511 | 19·6 | ·0383 | 26·1 | Per pair, | 414 |
| | 588 | „ | Cattle, | 6 | 30 | 2·590 | 87·3 | 12·7 | 0·344 | 0·394 | 0·700 | ·0840 | 11·9 | ·0560 | 17·9 | ·0420 | 23·8 | „ „ | 453 |
| | 602 | Dhenkli, | Men, | 1 | 10 | 0·436 | 100·0 | .. | 0·400 | 0·400 | 2·300 | ·1380 | 7·3 | ·0920 | 10·9 | ·0690 | 14·5 | Per man. | |
| | 603 | „ | „ | 1 | 10 | 0·436 | 100·0 | .. | 0·308 | 0·308 | 1·868 | ·1120 | 8·8 | ·0747 | 13·3 | ·0560 | 17·7 | „ „ | |
| | 605 | „ | „ | 1 | 10 | 0·394 | 100·0 | .. | 0·300 | 0·300 | 1·800 | ·1080 | 8·9 | ·0720 | 13·4 | ·0540 | 17·8 | „ „ | |
| | 109 | „ | „ | 1 | 10 | 0 394 | 100·0 | .. | 0·219 | 0·219 | 1·300 | ·0780 | 13·0 | ·0520 | 19·5 | ·0390 | 26·0 | „ „ | |
| | 608 | Ráti, | „ | 1 | 10 | 0·314 | 100·0 | .. | 0·238 | 0·238 | 1·416 | ·0848 | 11·8 | ·0566 | 17·6 | ·0424 | 23·5 | „ „ | 458 |
| | Average, | Dhenkli, | „ | 1 | 10 | 0·415 | 100·0 | .. | 0·309 | 0·309 | 1·816 | ·1088 | 9·2 | ·0726 | 13·8 | ·0544 | 18·4 | „ „ | 588 |

# TABLE G.

TABLE G.—*Showing the Cost of Irrigation per Acre of*

| District. | Number. | Class. | Labor. Class. | Labor. No. per well. | Depth to water surface. | Cost of lifting per day. | Depth of watering and cost per acre. ·1250. Days. | ·1250. Cost. | ·1860. Days. | ·1860. Cost. | ·2500. Days. | ·2500. Cost. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | RS.A.P. | | | | | | |
| Cawnpore, .. | 533 | Lagor, | Cattle, | 2 | 52 | 0-5-0 | 4·5 | 1·4 | 6·7 | 2·1 | 9·0 | 2·8 |
| ,, .. | 528 | ,, | ,, | 2 | 48 | 0-6-0 | 5·5 | 2·0 | 8·25 | 3·1 | 11 | 4·1 |
| ,, .. | 2 | ,, | ,, | 5 | 42 | 0-10-6 | 3 | 1·9 | 4·5 | 3 | 36 | 4·0 |
| ,, .. | 21 | ,, | ,, | 8 | 20 | 1-2-0 | 1·4 | 1·6 | 1·9 | 2·1 | 2·7 | 3·0 |
| ,, .. | 20 | ,, | ,, | 2 | 16 | 0-6-9 | 4·8 | 2·0 | 7·1 | 3·0 | 9·5 | 4·0 |
| Hamirpur, .. | 59 | ,, | ,, | 2 | 113 | 0-5-0 | 15 | 4·7 | 22·5 | 7·0 | 30 | 9·3 |
| ,, .. | 47 | ,, | ,, | 2 | 45 | 0-5-0 | 3·8 | 1·2 | 5·7 | 1·8 | 7·6 | 2·2 |
| ,, .. | 31 | ,, | ,, | 4 | 22 | 0-8-0 | 4 | 2·0 | 6 | 3·0 | 8 | 4·0 |
| ,, .. | 32 | ,, | ,, | 4 | 27 | 0-8-0 | 1·9 | 1·0 | 2·8 | 1·4 | 3·7 | 1·8 |
| ,, .. | 35 | ,, | ,, | 2 | 19 | 0-5-0 | 4·6 | 1·4 | 6·9 | 2·1 | 9·2 | 2·9 |
| ,, .. | 34 | ,, | ,, | 2 | 12 | 0-5-0 | 3·6 | 1·1 | 5·4 | 1·7 | 7·2 | 2·2 |
| Farukhabad, .. | 63 | ,, | ,, | 4 | 58 | 0-9-6 | 4·1 | 2·4 | 6·2 | 3·7 | 8·3 | 4·8 |
| ,, .. | 66 | ,, | ,, | 2 | 57 | 0-6-0 | 8·2 | 3·0 | 12·2 | 4·6 | 16·3 | 6·0 |
| ,, .. | 90 | ,, | ,, | 2 | 58 | 0-6-0 | 3·3 | 1·2 | 4·9 | 1·8 | 6·5 | 2·4 |
| ,, .. | 88 | ,, | ,, | 2 | 56 | 0-6-5 | 5·0 | 2·0 | 7·5 | 3·0 | 10·0 | 4·0 |
| ,, .. | 72 | ,, | ,, | 2 | 47 | 0-5-0 | 5·5 | 1·7 | 8·25 | 2·6 | 11·0 | 3·4 |
| ,, .. | 2 wells 69 | ,, | ,, | 5 | 46 | 0-13-0 | 3·2 | 2·6 | 4·8 | 4·0 | 6·4 | 5·2 |
| ,, .. | 92 | ,, | ,, | 2 | 36 | 0-5-0 | 4·5 | 1·4 | 6·7 | 2·1 | 9·0 | 2·8 |
| ,, .. | 94 | ,, | ,, | 2 | 35 | 0-7-0 | 3·4 | 1·5 | 5·1 | 2·2 | 6·8 | 3·0 |
| ,, .. | 74 | ,, | ,, | 2 | 35 | 0-5-6 | 3·3 | 1·1 | 5·0 | 1·7 | 6·6 | 2·2 |

*various Crops for a working day of 9 hours.*

| Command for the year. | | | | Total command, Acres. | Interest and Repairs. | | Cost of lifting per acre irrigated. | | | | Total Cost per Acre. | No of days required to irrigate command in Rabi. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Rabi.* | | *Kharif.* | | | Total per well. | Per acre irrigated. | *First Watering.* | | *After Waterings.* | Total per Acre. | | |
| Crop. | Area. | Crop. | Area. | | | | Depth. | Cost. | Depth. | Cost.* | Rs. | |
| Tobacco, | 1·70 | .. | .. | .. | 7·5 | 1·8 | ·1860 | 2·1 | ·1250 | 15·4 | 17·5 | 19·3 | 96 |
| Potatoes, | 1·70 | Kharif, | 1·70 | 4·10 | .. | .. | ·1250 | 1·4 | ·1250 | 15·4 | 16·8 | 18·6 | 87 |
| | | | | | | | | | | | | | 183 |
| Wheat, | 1·50 | „ | .. | .. | 7·5 | 1·1 | ·2500 | 4·1 | ·1860 | 6·2 | 10·3 | 11·4 | 41 |
| Tobacco, | 1·00 | „ | .. | .. | .. | .. | ·1860 | 3·1 | ·1250 | 22·0 | 25·1 | 26·2 | 69 |
| Potatoes, | 0·50 | „ | .. | .. | .. | .. | ·1250 | 2·0 | ·1250 | 22·0 | 24·0 | 25·1 | 33 |
| Garden, | 1·60 | „ | 2·30 | 6·90 | .. | .. | ·1250 | 2·0 | ·1250 | 18·0 | 20·0 | 21·1 | 111 |
| | | | | | | | | | | | | | 254 |
| Gujai, | 3·50 | Cotton, | 3·20 | 6·70 | 21·4 | 3·2 | ·1860 | 3·0 | ·1860 | 6·0 | 9·0 | 12·2 | 47 |
| Gujai, | 12 20 | „ | 2 0 | 14·20 | 46·2 | 3·2 | ·1860 | 2·1 | ·1860 | 4·2 | 6·3 | 9 5 | 70 |
| Wheat, | 1·50 | Kharif, | 0·75 | 2·25 | 17·3 | 7·6 | ·2500 | 4·0 | ·1860 | 6·0 | 10·0 | 17·6 | 35 |
| Opium, | 0·15 | „ | 0·07 | 0·22 | 29·5 | †134/- | ·1860 | 7·0 | ·1250 | 32·9 | 39·9 | 173·9 | 20 |
| Tobacco, | 3·40 | „ | 1·70 | 5·10 | 15·5 | 3·0 | ·1860 | 1·8 | ·1250 | 6·0 | 7·8 | 10·8 | 84 |
| Tobacco, | 2·83 | „ | 1·42 | 4·25 | 14·2 | 3·3 | ·1860 | 3·0 | ·1250 | 10·0 | 13·0 | 16·3 | 74 |
| Tobacco, | 4·00 | „ | 2·00 | 6·00 | 21·8 | 3·6 | ·1860 | 1·4 | ·1250 | 5·0 | 6·4 | 10·0 | 49 |
| Barley, | 4·70 | „ | 2·30 | 7·00 | 4·4 | 0·63 | ·1860 | 2·1 | ·1860 | 10·5 | 12·6 | 13·23 | 192 |
| Barley, | 2·00 | „ | 1·00 | 3·00 | 9·2 | 3·1 | ·1860 | 1·7 | ·1860 | 8·5 | 10·2 | 13·3 | 65 |
| Wheat, | 1·23 | Kharif, | 4·43 | 13·30 | 26·3 | 2·00 | ·2500 | 4·8 | ·1860 | 11·1 | 15·9 | 17·9 | 33 |
| Barley, | 7·23 | „ | .. | .. | .. | .. | ·1860 | 3·7 | ·1860 | 3·7 | 7·4 | 9·4 | 90 |
| Opium, | 0·40 | „ | .. | .. | .. | .. | ·1860 | 3·7 | ·1250 | 16·8 | 20·5 | 22·8 | 15 |
| | | | | | | | | | | | | | 138 |
| Gujai, | 2·11 | Kharif, | 1·6 | 2·70 | 21·3 | 8·0 | ·2500 | 6·0 | ·1860 | 9·2 | 15·2 | 23·2 | 86 |
| Tobacco, | 1·63 | Indian Corn, | 1·63 | 4 89 | 10·3 | 2·1 | ·1860 | 1·8 | ·1250 | 10·8 | 12·6 | 14·70 | 57 |
| Potatoes, | 1·63 | „ | .. | .. | .. | .. | ·1250 | 1·2 | ·0930 | 8·1 | 9·3 | 11·4 | 42 |
| | | | | | | | | | | | | | 99 |
| Tobacco, | 1·73 | „ | 1·50 | 5·19 | 11·3 | 2·1 | ·1860 | 3·0 | ·1250 | 18·0 | 21·0 | 23·1 | 90 |
| Potatoes, | 1·73 | Millet, | 0·23 | .. | .. | .. | ·1250 | 2·0 | ·0930 | 13·5 | 15·5 | 17·6 | 67 |
| | | | | | | | | | | | | | 157 |
| Barley, | 2·66 | Kharif, | 1·96 | 5·88 | 11·3 | 2·0 | ·1860 | 2·6 | ·1860 | 2·6 | 5·2 | 7·2 | 36 |
| Opium, | 1·26 | „ | .. | .. | .. | .. | ·1860 | 2·6 | ·1250 | 11·9 | 14·5 | 16·5 | 58 |
| | | | | | | | | | | | | | 94 |
| Wheat, | 4·26 | Kharif, | 3·87 | 11·62 | 21·4 | 1·8 | ·2500 | 5·2 | ·1860 | 12·0 | 17·2 | 19·0 | 89 |
| Barley, | 1·43 | „ | .. | .. | .. | .. | ·1860 | 4·0 | ·1860 | 4·0 | 8·0 | 9·8 | 14 |
| Opium, | 2·06 | „ | .. | .. | .. | .. | ·1860 | 4·0 | ·1250 | 18·2 | 22·2 | 24·0 | 55 |
| | | | | | | | | | | | | | 158 |
| Tobacco, | 1·29 | Millet, | 1·29 | 3·87 | 10·9 | 2·8 | ·1860 | 2·1 | ·1250 | 12·6 | 14·7 | 17·5 | 61 |
| Potatoes, | 1·29 | „ | .. | .. | .. | .. | ·1250 | 1·4 | ·0930 | 9·5 | 10·9 | 13·7 | 45 |
| | | | | | | | | | | | | | 106 |
| Tobacco, | 1·17 | Indian Corn, | 1·17 | 3·51 | 10·9 | 3·0 | ·1860 | 2·2 | ·1250 | 13·5 | 15·7 | 18·7 | 43 |
| Potatoes, | 1·17 | „ | .. | .. | .. | .. | ·1250 | 1·5 | ·0930 | 9·9 | 11·4 | 14·4 | 32 |
| | | | | | | | | | | | | | 75 |
| Wheat, | 0·66 | Kharif, | 1·57 | 4·72 | 8·3 | 1·7 | ·2500 | 2·2 | ·1860 | 5·1 | 7·3 | 9·0 | 15 |
| Gujai, | 0·86 | „ | .. | .. | .. | .. | ·2500 | 2·2 | ·1860 | 3·4 | 5·6 | 7·3 | 15 |
| Barley, | 1·26 | „ | .. | .. | .. | .. | ·1860 | 1·7 | ·1860 | 1·7 | 3·4 | 5·1 | 13 |
| Opium, | 0·37 | „ | .. | .. | .. | .. | ·1860 | 1·7 | ·1250 | 7·7 | 9·4 | 11·1 | 11 |
| | | | | | | | | | | | | | 54 |

* The number of after waterings required can be found by dividing the cost of after waterings by the cost of one watering of the required depth.

† Note depth to water surface.

TABLE G.—*Showing the Cost of Irrigation per Acre of*

| District. | Number. | Class. | Labor. Class. | Labor. No. per well. | Depth to water surface. | Cost of lifting per day. | Depth of watering and cost per acre. ·1250. Days. | ·1250. Cost. | ·1860. Days. | ·1860. Cost. | ·2500. Days. | ·2500. Cost. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Farukhabad—(*Continued*), | 98 | Lagor, | Cattle, | 2 | 32 | 0-5-6 | 4·8 | 1·6 | 7·1 | 2·4 | 9·5 | 3·2 |
| ,, .. | 87 | Dhenkli, | Men, | 1 | 16 | 0-1-0 | 8·5 | 0·53 | 12·5 | 0·8 | 17·0 | 1·06 |
| ,, .. | 86 | ,, | ,, | 1 | 15 | 0-1-0 | 9·9 | 0·62 | 14·1 | 0·9 | 18·7 | 1·20 |
| Mainpuri, .. | 153 | Kili, | Cattle, | 9 | 23 | 1-2-0 | 1·0 | 1·1 | 1·6 | 1·7 | 2·1 | 2·3 |
| ,, .. | 147 | Lagor, | ,, | 2 | 25 | 0-5-0 | 4·1 | 1·3 | 6·2 | 2·0 | 8·2 | 2·5 |
| ,, .. | 150 | Kili, | ,, | 6 | 24 | 0-13-0 | 2·6 | 2·1 | 3·9 | 3·1 | 5·2 | 4·2 |
| ,, .. | 100 | Lagor, | ,, | 8 | 21 | 1-3-6 | 1·3 | 1·6 | 2·1 | 2·5 | 2·6 | 3·2 |
| ,, .. | 123 | ,, | ,, | 6 | 21 | 0-13-6 | 1·7 | 1·4 | 2·8 | 2·3 | 3·5 | 2·8 |
| ,, .. | 143 | ,, | ,, | 4 | 21 | 0-9-0 | 1·3 | 0·7 | 2·0 | 1·1 | 2·7 | 1·5 |
| ,, .. | 96 | ,, | ,, | 4 | 19 | 0-10-6 | 4·2 | 2·8 | 6·3 | 4·0 | 8·4 | 5·5 |
| ,, .. | 110 | ,, | ,, | 16 | 20 | 1-14-0 | 1·3 | 2·4 | 1·9 | 3·5 | 2·5 | 4·8 |

*various Crops for a working day of* 9 *hours*—(Continued).

| Command for the year. | | | | Total command, Acres. | Interest and Repairs. | | Cost of lifting per acre Irrigated. | | | | | Total Cost per Acre. | No. of days required to irrigate command in Rabi. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Rabi.* | | *Kharif.* | | | Total per well. | Per acre irrigated. | *First Watering.* | | *After Waterings.* | | Total per Acre. | | |
| Crop. | Area. | Crop. | Area. | | | | Depth. | Cost. | Depth. | Cost. | | Rs. | |
| Wheat, | 1·09 | Kharif, | 1·35 | 4·04 | 8·3 | 2·0 | ·2500 | 3·2 | ·1860 | 7·2 | 10·4 | 12·4 | 34 |
| Gujai, | 1·60 | ,, | .. | .. | .. | .. | ·2500 | 3·2 | ·1860 | 4·8 | 8·0 | 10·0 | 38 |
| | | | | | | | | | | | | | 72 |
| Garden, | 0·60 | ,, | 0·30 | 0·900 | 1·6 | 1·8 | ·1250 | 0·53 | ·1250 | 5·83 | 6·36 | 8·16 | 61 |
| .. | 0·60 | ,, | 0·30 | 0·90 | 1·6 | 1·8 | ·1250 | 0·62 | ·1250 | 6·82 | 7·44 | 9·24 | 71 |
| Wheat, | 12·08 | ,, | 9·35 | 28·00 | 30·3 | 1·1 | ·2500 | 2·3 | ·1860 | 3·4 | 5·7 | 6·8 | 64 |
| Barley, | 6·63 | ,, | .. | .. | .. | .. | ·1860 | 1·7 | ·1860 | 1·7 | 3·4 | 4·5 | 22 |
| | | | | | | | | | | | | | 86 |
| Wheat, | 1·14 | ,, | 1·62 | 4·87 | 9·5 | 2·0 | ·2500 | 2·5 | ·1860 | 4·0 | 6·5 | 8·5 | 24 |
| Gujai, | 1·74 | ,, | .. | .. | .. | .. | ·1860 | 2·0 | ·1860 | 4·0 | 6·0 | 8·0 | 30 |
| Barley, | 0·39 | ,, | .. | .. | .. | .. | ·1860 | 2·0 | ·1860 | 2·0 | 4·0 | 6·0 | 5 |
| | | | | | | | | | | | | | 59 |
| Wheat, | 4·57 | ,, | 5·37 | 16·10 | 19·1 | 1·2 | ·2500 | 4·2 | ·1860 | 6·2 | 10·4 | 12·2 | 60 |
| Barley, | 5·77 | ,, | .. | .. | .. | .. | ·1860 | 3·1 | ·1860 | 3·1 | 6·2 | 7·4 | 46 |
| Carrots, | 0·40 | ,, | .. | .. | .. | .. | ·1860 | 3·1 | ·1250 | 18·9 | 22·0 | 23·2 | 11 |
| | | | | | | | | | | | | | 117 |
| Gujai, | 5·65 | ,, | 6·85 | 20·50 | 45·6 | 2·2 | ·1860 | 2·5 | ·1860 | 5·0 | 7·5 | 9·7 | 36 |
| Guchana, | 3·20 | ,, | .. | .. | .. | .. | ·1860 | 2·5 | ·1860 | 5·0 | 7·5 | 9·7 | 20 |
| Barley, Gram, | 3·86 | ,, | .. | .. | .. | .. | ·1860 | 2·5 | ·1860 | 2·5 | 5·0 | 7·2 | 17 |
| Opium, | 0·40 | ,, | .. | .. | .. | .. | ·1860 | 2·5 | ·1250 | 14·4 | 16·9 | 19·1 | 6 |
| Tobacco, | 0·20 | ,, | .. | .. | .. | .. | ·1860 | 2·5 | ·1250 | 14·4 | 16·9 | 19·1 | 3 |
| Garden, | 0·40 | ,, | .. | .. | .. | .. | ·1250 | 1·6 | ·1250 | 14·4 | 16·0 | 18·2 | 5 |
| | | | | | | | | | | | | | 87 |
| Wheat, | 4·70 | Sugar, | 1·80 | 15·0 | 23·3 | 1·5 | ·2500 | 2·8 | ·1860 | 4·6 | 7·4 | 8·9 | 43 |
| Gujai, | 1·97 | ,, | .. | .. | .. | .. | ·1860 | 2·3 | ·1860 | 4·6 | 6·9 | 8·4 | 16 |
| Barley, | 5·40 | ,, | .. | .. | .. | .. | ·1860 | 2·3 | ·1860 | 2·3 | 4·6 | 6·1 | 30 |
| Gram, | 0·40 | ,, | .. | .. | .. | .. | ·1860 | 2·3 | .. | .. | 2·3 | 3·8 | 1 |
| Carrots, | 0·77 | ,, | .. | .. | .. | .. | ·1860 | 2·3 | ·1250 | 12·6 | 14·9 | 16·4 | 14 |
| | | | | | | | | | | | | | 104 |
| Wheat, | 3·17 | Kharif, | 3·53 | 10·6 | 22·8 | 2·1 | ·2500 | 1·5 | ·1860 | 2·2 | 3·7 | 5·8 | 21 |
| Barley, | 1·90 | ,, | .. | .. | .. | .. | ·1860 | 1·1 | ·1860 | 1·1 | 2·2 | 4·3 | 8 |
| Carrots, | 0·70 | ,, | .. | .. | .. | .. | ·1860 | 1·1 | ·1250 | 6·3 | 7·4 | 9·5 | 10 |
| Potatoes, | 1·30 | ,, | .. | .. | .. | .. | ·1250 | 0·7 | ·0930 | 4·9 | 5·6 | 7·7 | 14 |
| | | | | | | | | | | | | | 53 |
| Wheat, | 1·40 | ,, | 3·23 | 9·7 | 23·8 | 2·4 | ·2500 | 5·5 | ·1860 | 8·0 | 13·5 | 15·9 | 30 |
| Gujai, | 3·83 | ,, | .. | .. | .. | .. | ·1860 | 4·0 | ·1860 | 8·0 | 12·0 | 14·4 | 72 |
| Barley, | 1·23 | ,, | .. | .. | .. | .. | ·1860 | 4·0 | ·1860 | 4·0 | 8·0 | 10·4 | 32 |
| | | | | | | | | | | | | | 134 |
| Wheat, | 9·90 | ,, | 8·4 | 25·3 | 30·1 | 1·2 | ·2500 | 4·8 | ·1860 | 7·0 | 11·8 | 13·0 | 63 |
| Gujai, | 2·10 | ,, | .. | .. | .. | .. | ·1860 | 3·5 | ·1860 | 7·0 | 10·5 | 11·9 | 12 |
| Barley, | 4·90 | ,, | .. | .. | .. | .. | ·1860 | 3·5 | ·1860 | 3·5 | 7·0 | 8·2 | 20 |
| | | | | | | | | | | | | | 95 |

TABLE G.—*Showing the Cost of Irrigation per Acre of*

| District. | Number. | Class. | Labor. | | Depth to water surface. | Cost of lifting per day. | Depth of watering and cost per acre. | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Class. | No. per well. | | | ·1250. | | ·1860. | | ·2500. | |
| | | | | | | | Days. | Cost. | Days. | Cost. | Days. | Cost. |
| Mainpuri—(*Continued,*) .. | 140 | Lagor, | Cattle, | 2 | 18 | 0-5-6 | 2·7 | 0·9 | 4·0 | 1·4 | 5·4 | 1·9 |
| „ .. | 173 | „ | „ | 8 | 18 | 1-1-0 | 1·6 | 1·7 | 2·4 | 2·1 | 3·2 | 3·4 |
| „ .. | 138 | „ | „ | 2 | 17 | 0-7-0 | 2·4 | 1·05 | 3·5 | 1·5 | 4·7 | 2·1 |
| „ .. | 117 | „ | „ | 9 | 19 | 1-7-6 | 0·9 | 1·3 | 1·4 | 2·0 | 1·8 | 2·7 |
| „ .. | 120 | „ | „ | 4 | 19 | 0-11-0 | 1·8 | 1·2 | 2·7 | 1·8 | 3·6 | 2·5 |
| „ .. | 141 | „ | „ | 2 | 17 | 0-6-0 | 3·3 | 1·2 | 5·0 | 1·9 | 6·6 | 2·5 |
| „ .. | 113 | „ | „ | 6 | 17 | 0-15-6 | 1·6 | 1·4 | 2·3 | 2·2 | 3·1 | 2·9 |
| „ .. | 128 | „ | „ | 8 | 17 | 1-1-6 | 1·2 | 1·3 | 1·7 | 1·8 | 2·3 | 2·6 |
| „ .. | 136 | „ | „ | 2 | 15 | 0-5-6 | 3·2 | 1·1 | 4·8 | 1·6 | 6·4 | 2·2 |
| „ .. | 106 | „ | „ | 8 | 15 | 1-2-0 | 1·2 | 1·3 | 1·8 | 2·0 | 2·4 | 2·7 |
| „ .. | 131 | „ | „ | 2 | 14 | 0-5-0 | 2·2 | 0·7 | 3·3 | 1·0 | 4·4 | 1·4 |
| „ .. | 155 | „ | „ | 8 | 13 | 1-4-0 | 0·9 | 1·1 | 1·4 | 1·7 | 1·9 | 2·3 |

*various Crops for a working day of 9 hours*—(Continued).

| Command for the year. | | | | Total command, Acres. | Interest and Repairs. | | Cost of lifting per acre irrigated. | | | | | Total Cost per Acre. | No. of days required to irrigate command in Rabi. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Rabi.* | | *Kharif.* | | | Total per well. | Per acre irrigated. | *First Watering.* | | *After Waterings.* | | Total per Acre. | | |
| Crop. | Area. | Crop. | Area. | | | | Depth. | Cost. | Depth. | Cost. | | Rs. | |
| Wheat, | 4·40 | Kharif, | 2·2 | 6·6 | 11·3 | 1·9 | ·2500 | 1·9 | ·1860 | 2·8 | 4·7 | 6·6 | 59 |
| Wheat, | 2·63 | ,, | 6·2 | 18·5 | 30·1 | 1·6 | ·2500 | 3·4 | ·1860 | 4·2 | 7·6 | 9·2 | 21 |
| Gujai, | 0·45 | ,, | .. | .. | .. | .. | ·1860 | 2·1 | ·1860 | 4·2 | 6·3 | 7·9 | 4 |
| Barley, | 7·70 | ,, | .. | .. | .. | .. | ·1860 | 2·1 | ·1860 | 2·1 | 4·2 | 5·8 | 37 |
| Gram, | 0·17 | ,, | .. | .. | .. | .. | ·1860 | 2·1 | .. | .. | 2·1 | 3·7 | 1 |
| Garden, | 1·40 | ,, | .. | .. | .. | .. | ·1250 | 1·7 | ·1250 | 15·3 | 17·0 | 18·6 | 33 |
| | | | | | | | | | | | | | 96 |
| Wheat, | 5·31 | ,, | 2·73 | 8·20 | 11·3 | 1·4 | ·2500 | 2·1 | ·1860 | 3·0 | 4·1 | 5·5 | 62 |
| Garden, | 0·15 | ,, | .. | .. | .. | .. | ·1250 | 1·05 | ·1250 | 13·40 | 14·5 | 15·9 | 4 |
| | | | | | | | | | | | | | 66 |
| Wheat, | 11·43 | Sugar, | 2·80 | 20·6 | 38·1 | 1·8 | ·2500 | 2·7 | ·1860 | 4·0 | 6·7 | 8·5 | 53 |
| Gujai, | 3·11 | ,, | .. | .. | .. | .. | ·1860 | 2·0 | ·1860 | 4·0 | 6·0 | 7·8 | 13 |
| Barley, | 3·23 | ,, | .. | .. | .. | .. | ·1860 | 2·0 | ·1860 | 2·0 | 4·0 | 5·8 | 9 |
| | | | | | | | | | | | | | 75 |
| Wheat, | 2·25 | ,, | 3·17 | 9·2 | 20·8 | 2·2 | ·2500 | 2·5 | ·1860 | 3·6 | 6·1 | 8·3 | 20 |
| Gujai, | 1·23 | ,, | .. | .. | .. | .. | ·1860 | 1·8 | ·1860 | 3·6 | 5·4 | 7·6 | 10 |
| Barley, | 2·51 | ,, | .. | .. | .. | .. | ·1860 | 1·8 | ·1860 | 1·8 | 3·6 | 5·8 | 14 |
| | | | | | | | | | | | | | 44 |
| Wheat, | 4·10 | Kharif, | 2·1 | 6·2 | 11·5 | 1·9 | ·2500 | 2·5 | ·1860 | 3·8 | 6·3 | 8·2 | 69 |
| Wheat, | 3·14 | ,, | 8·25 | 24·8 | 29·0 | 1·2 | ·2500 | 2·9 | ·1860 | 4·4 | 7·3 | 8·5 | 25 |
| Gujai, | 13·0 | ,, | .. | .. | .. | .. | ·1860 | 2·2 | ·1860 | 4·4 | 6·6 | 7·8 | 91 |
| Garden, | 0·37 | ,, | .. | .. | .. | .. | ·1250 | 1·4 | ·1250 | 12·6 | 14·0 | 15·2 | 6 |
| | | | | | | | | | | | | | 122 |
| Wheat, | 10·29 | ,, | 8·08 | 24·25 | 34·1 | 1·4 | ·2500 | 2·6 | ·1860 | 3·6 | 6·2 | 7·6 | 59 |
| Gujai, | 3·11 | ,, | .. | .. | .. | .. | ·1860 | 1·8 | ·1860 | 3·6 | 5·4 | 6·8 | 16 |
| Barley, | 2·77 | ,, | .. | .. | .. | .. | ·1860 | 1·8 | ·1860 | 1·8 | 3·6 | 5·0 | 10 |
| | | | | | | | | | | | | | 85 |
| Wheat, | 2·98 | ,, | 2·05 | 6·15 | 11·3 | 1·9 | ·2500 | 2·2 | ·1860 | 3·2 | 5·4 | 7·3 | 47 |
| Barley, | 1·12 | ,, | .. | .. | .. | .. | ·1860 | 1·6 | ·1860 | 1·6 | 3·2 | 5·1 | 12 |
| | | | | | | | | | | | | | 59 |
| Wheat, | 2·46 | ,, | 5·05 | 15·15 | 41·6 | 2·7 | ·2500 | 2·7 | ·1860 | 4·0 | 6·7 | 9·4 | 15 |
| Gujai, | 2·77 | ,, | .. | .. | .. | .. | ·1860 | 2·0 | ·1860 | 4·0 | 6·0 | 8·7 | 15 |
| Barley, | 2·97 | ,, | .. | .. | .. | .. | ·1860 | 2·0 | ·1860 | 2·0 | 4·0 | 6·7 | 11 |
| Garden, | 1·90 | ,, | .. | .. | .. | .. | ·1250 | 1·3 | ·1250 | 11·7 | 13·0 | 16·7 | 20 |
| | | | | | | | | | | | | | 61 |
| Wheat, | 4·46 | ,, | 2·68 | 8·05 | 13·1 | 1·6 | ·2500 | 1·4 | ·1860 | 2·0 | 3·4 | 5·0 | 49 |
| Tobacco, | 0·91 | ,, | .. | .. | .. | .. | ·1860 | 1·0 | ·1250 | 6·3 | 7·3 | 8·9 | 21 |
| | | | | | | | | | | | | | 70 |
| Wheat, | 8·14 | ,, | 9·75 | 29·25 | 35·5 | 1·2 | ·2500 | 2·3 | ·1860 | 3·4 | 5·7 | 6·9 | 39 |
| Gujai, | 2·03 | ,, | .. | .. | .. | .. | ·1860 | 1·7 | ·1860 | 3·4 | 5·1 | 6·3 | 9 |
| Guchana, | 5·30 | ,, | .. | .. | .. | .. | ·1860 | 1·7 | ·1860 | 3·4 | 5·1 | 6·3 | 23 |
| Barley, | 1·18 | ,, | .. | .. | .. | .. | ·1860 | 1·7 | ·1860 | 1·7 | 3·4 | 4·6 | 4 |
| Gram, | 2·86 | ,, | .. | .. | .. | .. | ·1860 | 1·7 | .. | .. | 1·7 | 2·9 | 4 |
| | | | | | | | | | | | | | 79 |

TABLE G.—*Showing the Cost of Irrigation per Acre of*

| District. | Number. | Class. | Labor. Class. | Labor. No. per well. | Depth to water surface. | Cost of lifting per day. | Depth of watering and cost per acre. ·1250. Days. | ·1250. Cost. | ·1860. Days. | ·1860. Cost. | ·2500. Days. | ·2500. Cost. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Mainpuri—(*Continued,*) .. | 160 | Lagor, | Cattle; | 13 | 13 | 1-11-0 | 1·0 | 2·0 | 1·4 | 2·7 | 2·0 | 3·9 |
| ,, .. | 4 wells. 161 | ,, | ,, | 18 | 12 | 2-10-0 | 0·6 | 1·6 | 0·9 | 2·3 | 1·2 | 3·1 |
| ,, .. | 170 | ,, | ,, | 4 | 12 | 0-10-0 | 2·7 | 1·7 | 4·1 | 2·6 | 5·4 | 3·4 |
| ,, .. | 133 | ,, | ,, | 2 | 10 | 0-5-6 | 3·3 | 1·1 | 4·9 | 1·7 | 6·5 | 2·3 |
| Etah, .. | 188 | Kili, Lagor, | ,, | 8 | 20 | 1-2-6 | 1·1 | 1·25 | 1·7 | 2·0 | 2·2 | 2·5 |
| ,, .. | 192 | Lagor, | ,, | 4 | 19 | 0-8-0 | 1·9 | 1·0 | 2·9 | 1·4 | 3·9 | 1·9 |
| ,, .. | 196 | Kili, | ,, | 4 | 20 | 0-7-6 | 1·1 | 0·5 | 1·7 | 0·8 | 2·2 | 1·0 |
| ,, .. | 2 wells, 178 | Lagor, | ,, | 6 | 14 | 0-14-6 | 1·8 | 1·6 | 2·7 | 2·4 | 3·7 | 3·2 |
| ,, .. | 180 | ,, | ,, | 4 | 12 | 0-10-0 | 2·7 | 1·7 | 4·1 | 2·5 | 5·5 | 3·4 |
| ,, .. | 183 | ,, | ,, | 4 | 12 | 0-8-6 | 2·7 | 1·4 | 4·0 | 2·1 | 5·3 | 2·8 |

*various Crops for a working day of* 9 *hours*—(Continued).

| Command for the year. | | | | Total command, Acres. | Interest and Repairs. | | Cost of lifting per acre irrigated. | | | | | Total Cost per Acre. | No. of days required to irrigate command in Rabi. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Rabi.* | | *Kharif.* | | | Total per well. | Per acre irrigated. | *First Watering.* | | *After Waterings.* | | Total per Acre. | | |
| Crop. | Area. | Crop. | Area. | | | | Depth. | Cost. | Depth. | Cost. | | Rs. | |
| Wheat, | 6·23 | Sugar, | 1·46 | 28·30 | 41·7 | 1·5 | ·2500 | 3·9 | ·1860 | 5·4 | 9·3 | 10·8 | 30 |
| Gujai | 1·68 | ,, | .. | .. | .. | .. | ·1860 | 2·7 | ·1860 | 5·4 | 8·1 | 9·6 | 8 |
| Guchana, | 3·47 | ,, | .. | .. | .. | .. | ·1860 | 2·7 | ·1860 | 5·4 | 8·1 | 9·6 | 15 |
| Barley, | 11·14 | ,, | .. | .. | .. | | ·1860 | 2·7 | ·1860 | 2·7 | 5·4 | 6·9 | 32 |
| Gram, | 2·50 | ,, | .. | .. | .. | .. | ·1860 | 2·7 | .. | .. | 2·7 | 4·2 | 4 |
| Opium, | 1·86 | ,, | .. | .. | .. | .. | ·1860 | 2·7 | ·1250 | 18·0 | 20·7 | 22·2 | 20 |
| | | | | | | | | | | | | | 109 |
| Wheat, | 20·3 | Kharif, | 14·42 | 43·25 | 36·8 | 0·8 | ·2500 | 3·1 | ·1860 | 4·6 | 7·7 | 8·5 | 61 |
| Gujai, | 3·50 | ,, | .. | .. | .. | .. | ·1860 | 2·3 | ·1860 | 4·6 | 6·9 | 7·7 | 10 |
| Guchana, | 1·37 | ,, | .. | .. | .. | .. | ·1860 | 2·3 | ·1860 | 4·6 | 6·9 | 7·7 | 4 |
| Barley, | 3·66 | ,, | .. | .. | .. | .. | ·1860 | 2·3 | ·1860 | 2·3 | 4·6 | 5·4 | 7 |
| | | | | | | | | | | | | | 82 |
| Wheat, | 6·00 | ,, | 4·91 | 14·75 | 23·3 | 1·6 | ·2500 | 3·4 | 1860 | 5·2 | 8·6 | 10·2 | 81 |
| Barley, | 3·30 | ,, | .. | .. | .. | .. | ·1860 | 2·6 | ·1860 | 2·6 | 5·2 | 6·8 | 27 |
| Carrots, | 0·54 | ,, | .. | .. | .. | .. | ·1860 | 2·6 | ·1250 | 15·3 | 17·9 | 19·5 | 17 |
| | | | | | | | | | | | | | 125 |
| Wheat, | 1·86 | ,, | 1·86 | 5·6 | 12·1 | 2·0 | ·2500 | 2·3 | ·1860 | 3·4 | 5·7 | 7·7 | 31 |
| Barley, | 1·50 | ,, | .. | .. | .. | .. | ·1860 | 1·7 | ·1860 | 1·7 | 3·4 | 5·4 | 14 |
| Opium, | 0·46 | ,, | .. | .. | .. | .. | ·1860 | 1·7 | ·1250 | 9·9 | 11·6 | 13·6 | 16 |
| | | | | | | | | | | | | | 61 |
| Wheat, | 7·63 | ,, | 4·45 | 13·40 | 31·9 | 2·4 | ·2500 | 2·5 | ·1860 | 4·0 | 6·5 | 8·9 | 43 |
| Barley, | 1·32 | ,, | .. | .. | .. | .. | ·1860 | 2·0 | ·1860 | 2·0 | 4·0 | 6·4 | 10 |
| | | | | | | | | | | | | | 53 |
| Wheat, | 1·30 | ,, | 3·9 | 9·6 | 17·3 | 1·8 | ·2500 | 1·9 | ·1860 | 2·8 | 4·7 | 6·5 | 13 |
| Barley, | 4·0 | ,, | .. | .. | .. | .. | ·1860 | 1·4 | ·1860 | 1·4 | 2·8 | 4·6 | 24 |
| Carrots, | 1·10 | ,, | .. | .. | .. | .. | ·1860 | 1·4 | ·1250 | 9·0 | 10·4 | 12·2 | 22 |
| | | | | | | | | | | | | | 59 |
| Wheat, | 1·70 | ,, | 3·03 | 9·10 | 19·1 | 2·1 | ·2500 | 1·0 | ·1860 | 1·6 | 2·6 | 4·7 | 10 |
| Barley, | 4·13 | ,, | .. | .. | .. | .. | ·1860 | 0·8 | ·1860 | 0·8 | 1·6 | 3·7 | 15 |
| Oats, | 0·24 | ,, | .. | .. | .. | .. | ·1860 | 0·8 | ·1860 | 4·0 | 4·8 | 6·9 | 3 |
| | | | | | | | | | | | | | 28 |
| Wheat, | 2·70 | Sugar, | 1·70 | 6·40 | 30·1 | 4·7 | ·2500 | 3·2 | ·1860 | 4·8 | 8·0 | 12·7 | 25 |
| Barley, | 2·00 | ,, | .. | .. | .. | .. | ·1860 | 2·4 | ·1860 | 2·4 | 4·8 | 9·5 | 11 |
| | | | | | | | | | | | | | 36 |
| Wheat, | 6·00 | Kharif, | 3·44 | 10·3 | 16·3 | 1·6 | ·2500 | 3·4 | ·1860 | 5·0 | 8·4 | 10·0 | 82 |
| Barley, | 0·66 | ,, | .. | .. | .. | .. | ·1860 | 2·3 | ·1860 | 2·5 | 5·0 | 6·6 | 6 |
| Opium, | 0·20 | ,, | .. | .. | .. | .. | ·1860 | 2·5 | ·1250 | 15·3 | 17·8 | 19·4 | 6 |
| | | | | | | | | | | | | | 94 |
| Wheat, | 2·30 | ,, | 2·5 | 10·4 | 16·3 | 1·5 | ·2500 | 2·8 | ·1860 | 4·2 | 7·0 | 8·5 | 31 |
| Gujai, | 1·26 | ,, | .. | .. | .. | .. | ·1860 | 2·1 | ·1860 | 4·2 | 6·3 | 7·8 | 15 |
| Barley, | 1·80 | ,, | .. | .. | .. | .. | ·1860 | 2·1 | ·1860 | 2·1 | 4·2 | 5·7 | 15 |
| Carrots, | 0·54 | ,, | .. | .. | .. | .. | ·1860 | 2·1 | ·1250 | 12·6 | 14·7 | 16·2 | 16 |
| Opium, | 1·00 | ,, | .. | .. | .. | .. | ·1860 | 2·1 | ·1250 | 12·6 | 14·7 | 16·2 | 29 |
| | | | | | | | | | | | | | 106 |

TABLE G.—*Showing the cost of Irrigation per Acre of*

| District. | Number. | Class. | Labor. | | Depth to water surface. | Cost of lifting per day. | Depth of watering and cost per acre. | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Class. | No. per well. | | | ·1250. | | ·1860. | | ·2500. | |
| | | | | | | | Days. | Cost. | Days. | Cost. | Days. | Cost. |
| Aligarh, .. | 255 | Kili, | Cattle, | 4 | 45 | 0-12-0 | 1·5 | 1·1 | 2·3 | 1·7 | 3·0 | 2·2 |
| ,, .. | 251 | ,, | ,, | 4 | 39 | 0-10-0 | 2·1 | 1·3 | 3·1 | 2·0 | 4·1 | 2·5 |
| ,, .. | 259 | ,, | ,, | 28 | 29 | 3-11-6 | 0·35 | 1·3 | 0·53 | 2·0 | 0·7 | 2·6 |
| ,, .. | 275 | ,, | ,, | 4 | 33 | 0-11-6 | 2 | 1·4 | 3 | 2·1 | 4 | 2·8 |
| ,, .. | 242 | ,, | ,, | 4 | 28 | 0-9-0 | 2·4 | 1·4 | 3·4 | 1·9 | 4·4 | 2·7 |
| ,, .. | 268 | ,, | ,, | 8 | 23 | 1 2-0 | 0·6 | 0·7 | 0·9 | 1·0 | 1·2 | 1·4 |
| ,, .. | 239 | ,, | ,, | 2 | 27 | 0-6-6 | 3·9 | 1·6 | 5·0 | 2·0 | 6·7 | 3·1 |
| ,, .. | 239<br>231 | ,, | ,, | 6 | 20 | 0-14-0 | 1·3 | 1·1 | 1·9 | 1·7 | 2·6 | 2·3 |
| ,, .. | 207 | ,, | ,, | 6 | 18 | 0-12-0 | 0·9 | 0·7 | 1·4 | 1·05 | 1·8 | 1·4 |

*various Crops for a working day of 9 hours*—(Continued).

| Command for the year. | | | | Total command, Acres. | Interest and Repairs. | | Cost of lifting per acre irrigated. | | | | | Total Cost per Acre. | No. of days required to irrigate command in Rabi. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Rabi.* | | *Kharif.* | | | Total per well. | Per acre irrigated. | *First Watering.* | | *After Waterings.* | | Total per Acre. | | |
| Crop. | Area. | Crop. | Area. | | | | Depth. | Cost. | Depth | Cost. | | Rs. | |
| Wheat, | 3·52 | Kharif, | 4·00 | 12·0 | 17·2 | 1·4 | ·2500 | 2·2 | ·1860 | 5·1 | 7·3 | 8·7 | 35 |
| Barley, | 3·46 | ,, | .. | .. | .. | .. | ·1860 | 1·7 | ·1860 | 3 4 | 5·1 | 6·5 | 24 |
| Garden, | 1·00 | ,, | .. | .. | .. | .. | ·1250 | 1·1 | ·1250 | 6·6 | 7·7 | 9·1 | 11 |
| | | | | | | | | | | | | | 70 |
| Wheat, | 3·63 | ,, | 2·80 | 8·5 | 10·6 | 1·2 | ·2500 | 2·5 | ·1860 | 6·0 | 8·5 | 9·7 | 39 |
| Barley, | 1·43 | ,, | .. | .. | .. | .. | ·1860 | 2·0 | ·1860 | 4·0 | 6·0 | 7·2 | 19 |
| Carrots, | 0·66 | ,, | .. | .. | .. | .. | ·1860 | 2·0 | ·1860 | 5·2 | 7·2 | 8·4 | 8 |
| | | | | | | | | | | | | | 66 |
| Wheat, | 27·20 | ,, | 21·0 | 63·0 | 105·0 | 1·7 | ·2500 | 2·6 | ·1860 | 6·0 | 8·6 | 10·3 | 63 |
| Barley, | 1·03 | ,, | .. | .. | .. | .. | ·1860 | 2·0 | ·1860 | 4·0 | 6·0 | 7·7 | 2 |
| Barley & Peas, | 9·94 | ,, | .. | .. | .. | .. | ·1860 | 2·0 | ·1860 | 4·0 | 6·0 | 7·7 | 16 |
| Safflower, Carrots, | 1·34 | ,, | .. | .. | .. | .. | ·1860 | 2·0 | ·1250 | 3·9 | 5·9 | 7·6 | 3 |
| Gujai, | 2·65 | ,, | .. | .. | .. | .. | ·1860 | 2·0 | ·1860 | 4·0 | 6·0 | 7·7 | 5 |
| | | | | | | | | | | | | | 89 |
| Wheat, | 5·20 | ,, | 8·30 | 25·0 | 32·3 | 1·3 | ·2500 | 2·8 | ·1860 | 6·3 | 9·1 | 10·4 | 68 |
| Barley & Peas, | 11 30 | ,, | .. | .. | .. | .. | ·1860 | 2·1 | ·1860 | 4·2 | 6·3 | 7·6 | 102 |
| Safflower, Gram, | 0·23 | ,, | .. | .. | .. | .. | ·1860 | 2·1 | .. | .. | 2·1 | 3·4 | 1 |
| | | | | | | | | | | | | | 171 |
| Wheat, | 2·71 | ,, | 3·22 | 9·66 | 12·4 | 1·3 | ·2500 | 2·7 | ·1860 | 5·7 | 8·4 | 9·7 | 40 |
| Safflower, Carrots, | 0·83 | ,, | .. | .. | .. | .. | ·1860 | 1·9 | ·1250 | 4·2 | 6·1 | 7·4 | 9 |
| Tobacco, | 0·80 | ,, | .. | .. | .. | .. | ·1860 | 1·9 | ·1250 | 12·6 | 14·5 | 15·8 | 20 |
| Potatoes, | 1·10 | ,, | .. | .. | .. | .. | ·1860 | 1·9 | ·1250 | 4·2 | 6·1 | 7·4 | 12 |
| Garlic, | 1·00 | ,, | .. | .. | .. | .. | ·1250 | 1·4 | ·1250 | 12·6 | 14·0 | 15·3 | 24 |
| | | | | | | | | | | | | | 105 |
| Wheat, | 9·90 | ,, | 11·50 | 34·50 | 57·5 | 1·7 | ·2500 | 1·4 | ·1860 | 3·0 | 4·4 | 6·1 | 40 |
| Gujai, | 3·40 | ,, | .. | .. | .. | .. | ·1860 | 1·0 | ·1860 | 2·0 | 3·0 | 4·7 | 10 |
| Barley, | 4·50 | ,, | .. | .. | .. | .. | ·1860 | 1·0 | ·1860 | 2·0 | 3·0 | 4·7 | 12 |
| Safflower, Carrots, | 1·26 | ,, | .. | .. | .. | .. | ·1860 | 1·0 | ·1250 | 2·1 | 3·0 | 4·7 | 4 |
| Tobacco, | 3·03 | ,, | .. | .. | .. | .. | ·1860 | 1·0 | ·1250 | 6·3 | 7·3 | 9·0 | 20 |
| Garden, | 0·90 | ,, | .. | .. | .. | .. | ·1250 | 0·7 | ·1250 | 4·3 | 5·0 | 6·7 | 4 |
| | | | | | | | | | | | | | 90 |
| Wheat, | 0·83 | ,, | 1·0 | 3·0 | 12·6 | 4·2 | ·2500 | 3·1 | ·1860 | 6·0 | 9·1 | 13·3 | 18 |
| Barley, | 1·12 | ,, | .. | .. | .. | .. | ·1860 | 2·0 | ·1860 | 4·0 | 6·0 | 10·2 | 18 |
| | | | | | | | | | | | | | 36 |
| Wheat, | 7·86 | Cotton, | 3·17 | 20·31 | 39·0 | 1·3 | ·2500 | 2·3 | ·1860 | 5·1 | 7·4 | 8·7 | 66 |
| Barley, | 7·17 | ,, | .. | .. | .. | .. | ·1860 | 1·7 | ·1860 | 3·4 | 5·1 | 6·4 | 42 |
| Safflower, | 0·60 | ,, | .. | .. | .. | .. | ·1860 | 1·7 | ·1250 | 2·2 | 3·9 | 5·2 | 3 |
| Peas, | 1·51 | ,, | .. | .. | .. | .. | ·1860 | 1·7 | ·1250 | 1·1 | 2·8 | 4·1 | 5 |
| | | | | | | | | | | | | | 116 |
| Wheat, | 3·50 | ,, | 3·57 | 13·48 | 20·1 | 1·5 | ·2500 | 1·4 | ·1860 | 4·15 | 5·5 | 7·0 | 21 |
| Barley, | 5·54 | ,, | .. | .. | .. | .. | ·1860 | 1·05 | ·1860 | 2·10 | 3·15 | 4·65 | 24 |
| Opium, | 0·30 | ,, | .. | .. | .. | .. | ·1860 | 1·05 | ·1250 | 6·3 | 7·35 | 8·85 | 3 |
| Tobacco, | 0·57 | ,, | .. | .. | .. | .. | ·1860 | 1·05 | ·1250 | 6·3 | 7·35 | 8·85 | 6 |
| | | | | | | | | | | | | | 54 |

TABLE G.—*Showing the Cost of Irrigation per Acre of*

| District. | Number. | Class. | Labor. Class. | Labor. No. per well. | Depth to water surface. | Cost of lifting per day. | Depth of watering and cost per acre. ·1250. Days. | ·1250. Cost. | ·1860. Days. | ·1860. Cost. | ·2500. Days. | ·2500. Cost. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Aligarh—(*Continued*), .. | 221 | Kili, | Cattle, | 2 | 17 | 0-5-6 | 1·4 | 0·5 | 2·2 | 0·8 | 3·0 | 1·0 |
| „ .. | 234 | „ | „ | 6 | 19 | 0-11-0 | 1·0 | 0·7 | 1·4 | 1·0 | 2·0 | 1·4 |
| „ .. | 217 | „ | „ | 12 | 16 | 1-12-0 | 0·5 | 0·9 | 0·8 | 1·4 | 1·0 | 1·8 |
| „ .. | 203 | „ | „ | 4 | 14 | 0-8-3 | 2·2 | 1·1 | 3·4 | 1·8 | 4·5 | 2·3 |
| „ .. | 211 | „ | „ | 6 | 16 | 0-14-0 | 0·8 | 0·7 | 1·3 | 1·1 | 1·7 | 1·4 |
| „ .. | 200 | „ | „ | 8 | 11 | 0-9-0 | 1·3 | 0·7 | 1·9 | 1·1 | 2·6 | 1·5 |
| Muttra, .. | 307, 309 | „ | „ | 8 | 67 | 1-2-6 | 1·6 | 1·8 | 2·4 | 2·8 | 3·1 | 3·6 |
| „ .. | 300 | Lagor, | „ | 4 | 62 | 1-0-0 | 2·9 | 2·9 | 4·4 | 4·4 | 5·9 | 5·9 |
| „ .. | 319 | Kili, | „ | 4 | 59 | 0-10-0 | 2·4 | 1·5 | 3·7 | 2·3 | 4·9 | 3·0 |

*various Crops for a working day of 9 hours*—(Continued).

| Command for the year. | | | | Total command, Acres. | Interest and Repairs. | | Cost of lifting per acre Irrigated. | | | | | Total Cost per Acre. | No. of days required to irrigate command in Rabi. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Rabi.* | | *Kharif.* | | | Total per well. | Per acre irrigated. | *First Watering.* | | *After Waterings.* | | Total per Acre. | | |
| Crop. | Area. | Crop. | Area. | | | | Depth. | Cost. | Depth. | Cost. | | Rs. | |
| Wheat, | 11·34 | Kharif, | 8·2 | 24·5 | 18·1 | 0·7 | ·2500 | 1·0 | ·1860 | 2·4 | 3·4 | 4·1 | 110 |
| Barley, | 4·91 | ,, | .. | .. | .. | .. | ·1860 | ·8 | ·1860 | 1·6 | 2·4 | 3·1 | 33 |
| Oats, | 0·12 | ,, | .. | .. | .. | .. | ·1860 | ·8 | ·1860 | 4·0 | 4·8 | 5·5 | 2 |
| | | | | | | | | | | | | | 145 |
| Wheat, | 7·34 | ,, | 7·4 | 22·2 | 43·5 | 2·0 | ·2500 | 1·4 | ·1860 | 3·0 | 4·4 | 6·4 | 46 |
| Barley, | 5·03 | ,, | .. | .. | .. | .. | ·1860 | 1·0 | ·1860 | 2·0 | 3·0 | 5·0 | 22 |
| Gram, | 1·14 | ,, | .. | .. | .. | .. | ·1860 | 1·0 | .. | .. | 1·0 | 3·0 | 2 |
| Tobacco, | 1·28 | ,, | .. | .. | .. | .. | ·1860 | 1·0 | ·1250 | 6·3 | 7·3 | 9·3 | 14 |
| | | | | | | | | | | | | | 84 |
| Wheat, | 10·90 | ,, | 11·2 | 33·7 | 28·8 | 0·8 | ·2500 | 1·8 | ·1860 | 4·2 | 6·0 | 6·8 | 37 |
| Barley, | 8·75 | ,, | .. | .. | .. | .. | ·1860 | 1·4 | ·1860 | 2·8 | 4·2 | 5·0 | 27 |
| Gram, | 2·80 | ,, | .. | .. | .. | .. | ·1860 | 1·4 | .. | .. | 1·4 | 2·2 | 3 |
| | | | | | | | | | | | | | 67 |
| Wheat, | 4·98 | ,, | 4·2 | 12·75 | 17·1 | 1·3 | ·2500 | 2·3 | ·1860 | 5·4 | 7·7 | 9·0 | 73 |
| Gujai, | 1·43 | ,, | .. | .. | .. | .. | ·1860 | 1·8 | ·1860 | 3·6 | 5·4 | 6·7 | 15 |
| Gram, | 2·11 | ,, | .. | .. | .. | .. | ·1860 | 2·8 | .. | .. | 1·8 | 3·1 | 8 |
| | | | | | | | | | | | | | 96 |
| Wheat, | 2·03 | Cotton, | 2·43 | 9·48 | 24·8 | 2·5 | ·2500 | 1·4 | ·1860 | 3·3 | 4·7 | 7·2 | 12 |
| Gujai, | 1·71 | ,, | .. | .. | .. | .. | ·1860 | 1·1 | ·1860 | 2·2 | 3·3 | 5·8 | 7 |
| Barley, | 3·83 | ,, | .. | .. | .. | .. | ·1860 | 1·1 | ·1860 | 2·2 | 3·3 | 5·8 | 15 |
| Opium, | 0·20 | ,, | .. | .. | .. | .. | ·1860 | 1·1 | ·1250 | 6·3 | 7·4 | 9·9 | 2 |
| Tobacco, | 1·28 | ,, | .. | .. | .. | .. | ·1860 | 1·1 | ·1250 | 6·3 | 7·4 | 9·9 | 12 |
| | | | | | | | | | | | | | 48 |
| Wheat, | 8·70 | Kharif, | 4·6 | 14·0 | 16·6 | 1·2 | ·2500 | 1·5 | ·1860 | 3·3 | 4·8 | 6·0 | 73 |
| Barley, | 0·73 | ,, | .. | .. | .. | .. | ·1860 | 1·1 | ·1860 | 2·2 | 3·3 | 4·5 | 5 |
| | | | | | | | | | | | | | 78 |
| Wheat, | 7·81 | ,, | 6·76 | 20·28 | 69·4 | 3·4 | ·2500 | 3·6 | ·1860 | 7·8 | 11·4 | 14·8 | 81 |
| Barley, | 5·71 | ,, | .. | .. | .. | .. | ·1860 | 2·8 | ·1860 | 5·6 | 8·4 | 11·8 | 42 |
| | | | | | | | | | | | | | 123 |
| Wheat, | 5·71 | ,, | 3·5 | 10·50 | 39·3 | 3·7 | ·2500 | 5·9 | ·1860 | 13·2 | 19·1 | 22·8 | 109 |
| Barley, | 0·73 | ,, | .. | .. | .. | .. | ·1860 | 4·4 | ·1860 | 8·8 | 13·2 | 16·9 | 10 |
| Safflower & Carrots, | 0·57 | ,, | .. | .. | .. | .. | ·1860 | 4·4 | ·1520 | 11·6 | 16·0 | 19·7 | 10 |
| | | | | | | | | | | | | | 129 |
| Wheat, | 4·72 | ,, | 2·25 | 6·70 | 39·2 | 5·8 | ·2500 | 3·0 | ·1860 | 6·9 | 9·9 | 15·7 | 76 |
| Barley, | 2·73 | ,, | .. | .. | .. | .. | ·1860 | 2·3 | ·1860 | 4·6 | 6·9 | 12·7 | 31 |
| Barley and Peas, | 1·06 | ,, | .. | .. | .. | .. | ·1860 | 2·3 | ·1860 | 2·3 | 4·6 | 10·4 | 8 |
| Safflower & Carrots, | 0·64 | ,, | .. | .. | .. | .. | ·1860 | 2·3 | ·1250 | 6·0 | 8·3 | 14·1 | 9 |
| Garden, | 0·02 | ,, | .. | .. | .. | .. | ·1250 | 1·5 | ·1250 | 13·5 | 15·0 | 20·8 | 1 |
| | | | | | | | | | | | | | 125 |

TABLE G.—*Showing the Cost of Irrigation per Acre of*

| District. | Number. | Class. | Labor. | | Depth to water surface. | Cost of lifting per day. | Depth of watering and cost per acre. | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Class. | No. per well. | | | ·1250. | | ·1860. | | ·2500. | |
| | | | | | | | Days. | Cost. | Days. | Cost. | Days. | Cost. |
| Muttra—(*Continued*), .. | 325 | Kili, | Cattle, | 4 | 59 | 0-9-0 | 1·9 | 1·1 | 3·0 | 1·7 | 3·9 | 2·2 |
| „ .. | 315 | „ | „ | 4 | 58 | 0-8-0 | 2·9 | 1·5 | 4·4 | 2·2 | 5·9 | 2·9 |
| „ .. | 312 | „ | „ | 2 | 58 | 0-6-6 | 4·8 | 2·0 | 7·2 | 2·9 | 9·6 | 3·9 |
| „ .. | 287 | „ | „ | 2 | 51 | 0-7-0 | 3·1 | 1·4 | 4·7 | 2·0 | 6·2 | 2·7 |
| „ .. | 291 | „ | „ | 2 | 49 | 0-6-0 | 2·9 | 1·1 | 4·4 | 1·7 | 5·9 | 2·2 |
| Bulandshahr, .. | 374 | „ | „ | 12 | 30 | 1-8-0 | 1·1 | 1·8 | 1·6 | 2·7 | 2·4 | 3·6 |
| „ .. | 389 | „ | „ | 8 | 26 | 1-1-0 | 1·5 | 1·6 | 2·2 | 2·3 | 3·0 | 3·2 |
| „ .. | 369 | „ | „ | 4 | 27 | 0-10-0 | 1·8 | 1·1 | 2·8 | 1·8 | 3·7 | 2·3 |
| „ .. | 359 | „ | „ | 8 | 27 | 1-1-0 | 1·8 | 1·9 | 2·7 | 2·9 | 3·6 | 3·8 |

*various Crops for a working day of* 9 *hours*—(Continued).

| Command for the year. | | | | Total command, Acres. | Interest and Repairs. | | Cost of lifting per acre Irrigated. | | | | | Total Cost per Acre. | No. of days required to irrigate command in Rabi. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Rabi.* | | *Kharif.* | | | Total per well. | Per acre irrigated. | *First Watering.* | | *After Waterings.* | | Total per Acre. | | |
| Crop. | Area. | Crop. | Area. | | | | Depth. | Cost. | Depth. | Cost. | | Rs. | |
| Gujai, | 0·71 | Kharif, | 5·24 | 15·73 | 15·8 | 1·0 | ·1860 | 1·7 | ·1860 | 6·8 | 8·5 | 9·5 | 4 |
| Barley, | 0·32 | ,, | .. | .. | .. | .. | ·1860 | 1·7 | ·1860 | 3·4 | 5·1 | 6·1 | 3 |
| Barley & Peas, | 9·46 | ,, | .. | .. | .. | .. | ·1860 | 1·7 | ·1860 | 1·7 | 3·4 | 4·4 | 57 |
| | | | | | | | | | | | | | 64 |
| Wheat, | 0·63 | ,, | 0·87 | 2·62 | 11·4 | 4·0 | ·2500 | 2·9 | ·1860 | 6·6 | 9·5 | 13·5 | 12 |
| Gujai, | 1·10 | ,, | .. | .. | .. | .. | ·1860 | 2·2 | ·1860 | 6·6 | 8·8 | 12·8 | 20 |
| Garden, | 0·02 | ,, | .. | .. | .. | .. | ·1250 | 1·5 | ·1250 | 13·5 | 15·0 | 19·0 | 1 |
| | | | | | | | | | | | | | 33 |
| Wheat, | 4·20 | ,, | 2·12 | 6·35 | 33·1 | 5·2 | ·2500 | 3·9 | ·1860 | 8·7 | 12·6 | 17·8 | 131 |
| Garden, | 0·03 | ,, | .. | .. | .. | .. | ·1250 | 2·0 | ·1250 | 18·0 | 20·0 | 25·2 | 2 |
| | | | | | | | | | | | | | 133 |
| Wheat, | 2·56 | ,, | 2·70 | 8·00 | 21·2 | 2·6 | ·2500 | 2·7 | ·1860 | 6·0 | 8·7 | 11·3 | 53 |
| Guchana, | 1·37 | ,, | .. | .. | .. | .. | ·1860 | 2·0 | ·1860 | 6·0 | 8·0 | 10·6 | 27 |
| Barley, | 1·37 | ,, | .. | .. | .. | .. | ·1860 | 2·0 | ·1860 | 4·0 | 6·0 | 8·6 | 20 |
| | | | | | | | | | | | | | 100 |
| Barley & Gram, | 6·59 | ,, | 3·30 | 9·90 | 19·2 | 2·0 | ·1860 | 1·7 | ·1860 | 3·4 | 5·1 | 7·1 | 87 |
| Gujai, | 10·60 | ,, | 14·38 | 43·00 | 30·3 | 0·7 | ·1860 | 2·7 | ·1860 | 8·1 | 10·8 | 11·5 | 68 |
| Guchana, | 1·78 | ,, | .. | .. | .. | .. | ·1860 | 2·7 | ·1860 | 5·4 | 8·1 | 8·8 | 9 |
| Barley, | 11·40 | ,, | .. | .. | .. | .. | ·1860 | 2·7 | ·1860 | 5·4 | 8·1 | 8·8 | 55 |
| Gram, | 1·34 | ,, | .. | .. | .. | .. | ·1860 | 2·7 | ·1860 | 2·7 | 5·4 | 6·1 | 5 |
| Peas, | 0·50 | ,, | .. | .. | .. | .. | ·1860 | 2·7 | ·1250 | 1·8 | 4·5 | 5·2 | 2 |
| Tobacco, | 3·00 | ,, | .. | .. | .. | .. | ·1860 | 2·7 | ·1250 | 14·4 | 17·1 | 17·8 | 32 |
| | | | | | | | | | | | | | 171 |
| Wheat, | 4·81 | ,, | 9·26 | 27·80 | 31·8 | 1·2 | ·2500 | 3·2 | ·1860 | 6·9 | 10·1 | 11·3 | 47 |
| Barley & Peas, | 5·09 | ,, | .. | .. | .. | .. | ·1860 | 2·3 | ·1860 | 4·6 | 6·9 | 8·1 | 34 |
| Safflower, | 5·61 | ,, | .. | .. | .. | .. | ·1860 | 2·3 | ·1250 | 3·2 | 5·5 | 6·7 | 30 |
| Garden, | 3·03 | ,, | .. | .. | .. | .. | ·1860 | 2·3 | ·1250 | 11·2 | 13·5 | 14·7 | 39 |
| | | | | | | | | | | | | | 150 |
| Wheat, | 2·09 | ,, | 1·98 | 5·90 | 12·9 | 2·2 | ·2500 | 2·3 | ·1860 | 5·4 | 7·7 | 9·9 | 25 |
| Barley, | 0·06 | ,, | .. | .. | .. | .. | ·1860 | 1·8 | ·1860 | 3·6 | 5·4 | 7·6 | 1 |
| Tobacco, | 1·15 | ,, | .. | .. | .. | .. | ·1860 | 1·8 | ·1250 | 8·8 | 10·6 | 12·8 | 21 |
| Garden, | 0·62 | ,, | .. | .. | .. | .. | ·1860 | 1·8 | ·1250 | 7·7 | 9·5 | 11·7 | 10 |
| | | | | | | | | | | | | | 57 |
| Wheat, | 5·53 | ,, | 9·64 | 29·00 | 27·5 | 0·9 | ·2500 | 3·8 | ·1860 | 8·7 | 12·5 | 13·4 | 66 |
| Gujai, | 1·63 | ,, | .. | .. | .. | .. | ·1860 | 2·9 | ·1860 | 8·7 | 11·6 | 12·5 | 18 |
| Guchana, | 2·65 | ,, | .. | .. | .. | .. | ·1860 | 2·9 | ·1860 | 5·8 | 8·7 | 9·6 | 22 |
| Barley, | 0·22 | ,, | .. | .. | .. | .. | ·1860 | 2·9 | ·1860 | 5·8 | 8·7 | 9·6 | 2 |
| Barley & Peas, | 1·56 | ,, | .. | .. | .. | .. | ·1860 | 2·9 | ·1860 | 5·8 | 8·7 | 9·6 | 13 |
| Gram, | 2·56 | ,, | .. | .. | .. | .. | ·1860 | 2·9 | ·1860 | 2·9 | 5·8 | 6·7 | 14 |
| Peas, | 0·56 | ,, | .. | .. | .. | .. | ·1860 | 2·9 | ·1250 | 1·9 | 4·8 | 5·7 | 3 |
| Tobacco, | 3·0 | ,, | .. | .. | .. | .. | ·1860 | 2·9 | ·1250 | 16·2 | 19·1 | 20·0 | 52 |
| Garden, | 1·65 | ,, | .. | .. | .. | .. | ·1860 | 2·9 | ·1250 | 13·3 | 16·2 | 17·1 | 26 |
| | | | | | | | | | | | | | 216 |

TABLE G.—*Showing the Cost of Irrigation per Acre of*

| District. | Number. | Class. | Labor. Class. | Labor. No. per well. | Depth to water surface. | Cost of lifting per day. | Depth of watering and cost per acre. ·1250. Days. | ·1250. Cost. | ·1860. Days. | ·1860. Cost. | ·2500. Days. | ·2500. Cost. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Bulandshahr—(*Continued*), | 346 | Kili, | Cattle, | 6 | 23 | 0-11-0 | 1·1 | 0·8 | 1·6 | 1·1 | 2·1 | 1·5 |
| ,, .. | 381 | ,, | ,, | 4 | 18 | 0-8-6 | 1·8 | 1·0 | 2·7 | 1·3 | 3·6 | 1·9 |
| ,, .. | 386 | ,, | ,, | 4 | 16 | 0-8-0 | 1·5 | 0·8 | 2·3 | 1·1 | 3·0 | 1·5 |
| ,, .. | 400 | ,, | ,, | 4 | 16 | 0-8-0 | 1·6 | 0·8 | 2·5 | 1·25 | 3·2 | 1·6 |
| ,, .. | 394 | ,, | ,, | 4 | 15 | 0-9-0 | 1·2 | 0·7 | 1·9 | 1·1 | 2·5 | 1·4 |
| Meerut, .. | 434 | ,, | ,, | 8 | 27 | 1-6-3 | 0·95 | 1·3 | 1·4 | 2·0 | 1·9 | 2·7 |
| ,, .. | 430 | ,, | ,, | 12 | 25 | 1-12-6 | 0·65 | 1·16 | 0·83 | 1·5 | 1·1 | 2·30 |
| ,, .. | 425 | ,, | ,, | 8 | 24 | 1-2-3 | 0·95 | 1·1 | 1·4 | 1·6 | 1·9 | 2·1 |

*various Crops for a working day of* 9 *hours*—(Continued).

| Command for the year. | | | | Total command, Acres. | Interest and Repairs. | | Cost of lifting per acre Irrigated. | | | | | Total Cost per Acre. | No. of days required to irrigate command in Rabi. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Rabi.* | | *Kharif.* | | | Total per well. | Per acre irrigated. | *First Watering.* | | *After Waterings.* | | Total per Acre. | | |
| Crop. | Area. | Crop. | Area. | | | | Depth. | Cost. | Depth. | Cost. | | Rs. | |
| Wheat, | 4·50 | Cotton, | 2·20 | 24·21 | 40·0 | 1·6 | ·2500 | 1·5 | ·1860 | 3·3 | 4·8 | 6·4 | 31 |
| Barley, | 3·84 | ,, | .. | .. | .. | .. | ·1860 | 1·1 | ·1860 | 2·2 | 3·3 | 4·9 | 19 |
| Safflower, | 12·0 | ,, | .. | .. | .. | .. | ·1860 | 1·1 | ·1250 | 1·6 | 2·7 | 4·3 | 46 |
| Oats, | 0·07 | ,, | .. | .. | .. | .. | ·1860 | 1·1 | ·1250 | 4·0 | 5·1 | 6·7 | 1 |
| Tobacco, | 1·13 | ,, | .. | .. | .. | .. | ·1860 | 1·1 | ·1250 | 6·4 | 7·5 | 9·1 | 13 |
| Garden, | 0·47 | ,, | .. | .. | .. | .. | ·1860 | 1·1 | ·1250 | 5·6 | 6·7 | 8·3 | 5 |
| | | | | | | | | | | | | | 115 |
| Wheat, | 2·56 | Kharif, | 3·31 | 10·00 | 11·6 | 1·1 | ·2500 | 1·9 | ·1860 | 3·9 | 5·8 | 6·9 | 31 |
| Gujai, | 2·12 | ,, | .. | .. | .. | .. | ·1860 | 1·3 | ·1860 | 3·9 | 5·2 | 6·3 | 24 |
| Peas, | 1·70 | ,, | .. | .. | .. | .. | ·1860 | 1·3 | ·1250 | 1·0 | 2·3 | 3·4 | 8 |
| Garden, | 0·31 | ,, | .. | .. | .. | .. | ·1860 | 1·3 | ·1250 | 7·0 | 8·3 | 9·4 | 5 |
| | | | | | | | | | | | | | 68 |
| Wheat, | 0·88 | ,, | 2·15 | 6·50 | 11·6 | 1·8 | ·2500 | 1·5 | ·1860 | 3·3 | 4·8 | 6·6 | 9 |
| Garden, | 3·47 | ,, | .. | .. | .. | .. | ·1860 | 1·1 | ·1250 | 5·6 | 6·7 | 8·5 | 45 |
| | | | | | | | | | | | | | 54 |
| Wheat, | 4·12 | Sugar, | 2·80 | 12·00 | 20·1 | 1·6 | ·2500 | 1·6 | ·1860 | 3·7 | 5·3 | 6·9 | 45 |
| Guchana, | 0·96 | Cotton, | 1·12 | .. | .. | .. | ·1860 | 1·3 | ·1860 | 2·5 | 3·8 | 5·4 | 8 |
| Barley, | 0·13 | ,, | .. | .. | .. | .. | ·1860 | 1·3 | ·1860 | 2·5 | 3·8 | 5·4 | 1 |
| Barley & Peas, | 2·70 | ,, | .. | .. | .. | .. | ·1860 | 1·3 | ·1860 | 2·5 | 3·8 | 5·4 | 21 |
| Tobacco, | 0·20 | ,, | .. | .. | .. | .. | ·1860 | 1·3 | ·1250 | 6·4 | 7·7 | 9·3 | 3 |
| | | | | | | | | | | | | | 78 |
| Wheat, | 5·38 | Kharif, | 5·95 | 17·80 | 21·1 | 1·2 | ·2500 | 1·4 | ·1860 | 3·3 | 4·7 | 5·9 | 45 |
| Gujai, | 0·88 | ,, | .. | .. | .. | .. | ·1860 | 1·1 | ·1860 | 3·3 | 4·4 | 5·6 | 7 |
| Barley, | 1·57 | ,, | .. | .. | .. | .. | ·1860 | 1·1 | ·1860 | 2·2 | 3·3 | 4·5 | 10 |
| Barley & Peas, | 3·36 | ,, | .. | .. | .. | .. | ·1860 | 1·1 | ·1860 | 2·2 | 3·3 | 4·5 | 20 |
| Garden, | 0·66 | ,, | .. | .. | .. | .. | ·1860 | 1·1 | ·1250 | 4·9 | 6·0 | 7·2 | 8 |
| | | | | | | | | | | | | | 90 |
| Wheat, | 7·22 | ,, | 5·60 | 16·80 | 32·3 | 2·0 | ·2500 | 2·7 | ·1860 | 6·0 | 8·7 | 10·7 | 45 |
| Potatoes, | 2·70 | ,, | .. | .. | .. | .. | ·1250 | 1·3 | ·0930 | 9·0 | 10·3 | 12·3 | 20 |
| Garden, | 1·78 | ,, | .. | .. | .. | .. | ·1860 | 2·0 | ·1250 | 7·8 | 9·8 | 11·8 | 10 |
| | | | | | | | | | | | | | 75 |
| Wheat, | 14·43 | ,, | 13·0 | 39·00 | 45·5 | 1·2 | ·2500 | 2·30 | ·1860 | 4·5 | 6·8 | 8·0 | 53 |
| Guchana, | 9·0 | ,, | .. | .. | .. | .. | ·2500 | 2·30 | ·1860 | 4·5 | 6·8 | 8·0 | 35 |
| Barley, | 2·62 | ,, | .. | .. | .. | .. | ·2500 | 2·30 | ·1860 | 3·0 | 5·3 | 6·5 | 8 |
| | | | | | | | | | | | | | 96 |
| Wheat, | 9·25 | Sugar, | 7·75 | 27·80 | 32·3 | 1·2 | ·2500 | 2·1 | ·1860 | 4·8 | 6·9 | 8·1 | 57 |
| Barley & Peas, | 7·20 | Cotton, | 2·0 | .. | .. | .. | ·1860 | 1·6 | ·1860 | 3·2 | 4·8 | 6·0 | 31 |
| Gram, | 0·70 | ,, | .. | .. | .. | .. | ·1860 | 1·6 | .. | .. | 1·6 | 2·8 | 1 |
| Peas, | 0·88 | ,, | .. | .. | .. | .. | ·1860 | 1·6 | ·1250 | 1·1 | 2·7 | 3·9 | 3 |
| | | | | | | | | | | | | | 92 |

TABLE G.—*Showing the Cost of Irrigation per Acre of*

| District. | Number. | Class. | Labor. Class. | Labor. No. per well. | Depth to water surface. | Cost of lifting per day. | Depth of watering and cost per acre. ·1250. Days. | ·1250. Cost. | ·1860. Days. | ·1860. Cost. | ·2500. Days. | ·2500. Cost. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Meerut—*(Continued)*, .. | 3 wells. 410 | Kili, | Cattle, | 16 | 25 | 1-10-3 | 0·36 | 0·6 | 0·54 | 0·9 | 0·7 | 1·2 |
| ,, .. | 406 | ,, | ,, | 4 | 23 | 0-10-0 | 2·0 | 1·25 | 3·0 | 1·9 | 4·1 | 2·50 |
| ,, .. | 439 | ,, | ,, | 4 | 19 | 0-9-0 | 1·5 | 0·85 | 2·3 | 1·3 | 3·1 | 1·7 |
| Muzaffarnagar, .. | 444 | ,, | ,, | 8 | 15 | 1-0-0 | 1·15 | 1·15 | 1·72 | 1·72 | 2·3 | 2·3 |
| Saharanpur, .. | 451 | Lagor, | ,, | 4 | 18 | 0-10-0 | 2·6 | 1·6 | 3·9 | 2·4 | 5·2 | 3·2 |
| ,, .. | 449 | ,, | ,, | 2 | 16 | 0-7-0 | 3·3 | 1·45 | 5·0 | 2·2 | 6·6 | 2·9 |
| Bijnor, .. | 461 | Dhenkli, | Men, | 1 | 20 | 0-1-0 | 15 | 1·0 | 22·5 | 1·4 | 30·0 | 1·9 |
| ,, .. | 463 | ,, | ,, | 1 | 20 | 0-1-0 | 19·8 | 1·24 | 29·0 | 1·8 | 38·7 | 2·5 |
| ,, .. | 465, 467 | Kili, | Cattle, | 2 wells. 16 | 16 | 2-2-0 | 0·85 | 1·8 | 1·3 | 2·7 | 1·7 | 3·6 |
| ,, .. | 469 | ,, | ,, | 8 | 16 | 1-1-0 | 1·7 | 1·8 | 2·6 | 2·7 | 3·4 | 3·6 |
| Moradabad, .. | 478 | ,, | ,, | 4 | 20 | 0-8-0 | 2·7 | 1·35 | 4·0 | 2·0 | 5·3 | 2·7 |
| ,, .. | 2 wells. 471 | ,, | ,, | 8 | 18 | Sugar. 1-6-0 | 1·5 | 2·1 | 2·2 | 3·0 | 3·0 | 4·1 |
| ,, .. | 476 | ,, | ,, | 2 | 18 | 0-6-0 | 2·5 | 0·94 | 3·8 | 1·3 | 5·0 | 1·9 |
| ,, .. | 484 | Dhenkli, | Men, | 2 | 19 | 0-2-0 | 4·8 | 0·6 | 7·3 | 0·9 | 9·7 | 1·2 |
| ,, .. | 480 | ,, | ,, | 2 | 10 | 0-3-0 | 4·1 | 0·8 | 6·1 | 1·1 | 8·2 | 1·6 |
| Rampur State, .. | 488 | Ráti, | ,, | 1 | 21 | 0-1-0 | 10 | 0·6 | 1·5 | 0·9 | 20 | 1·3 |
| Bareilly, .. | 3 wells. 490 | Kili, | Cattle, | 6 | 38 | 1-2-0 | 0·9 | 1·0 | 1·3 | 1·5 | 1·8 | 2·0 |
| ,, .. | 494 | ,, | ,, | 2 | 38 | 0-7-0 | 4·1 | 1·8 | 6·1 | 2·7 | 8·1 | 3·6 |

*various Crops for a working day of* 9 *hours*—(Continued).

| Command for the year. | | | | Total command, Acres. | Interest and Repairs. | | Cost of lifting per acre Irrigated. | | | | Total per Acre. | Total Cost per Acre. | No. of days required to irrigate command in Rabi. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Rabi.* | | *Kharif.* | | | Total per well. | Per acre irrigated. | *First Watering.* | | *After Waterings.* | | | | |
| Crop. | Area. | Crop. | Area. | | | | Depth. | Cost. | Depth. | Cost. | | Rs. | |
| Wheat, | 15·0 | Cotton, | 2·60 | 26·89 | 55·5 | 2·1 | ·2500 | 1·2 | ·1860 | 2·7 | 3·9 | 6·0 | 35 |
| Gujai, | 3·80 | „ | .. | .. | .. | .. | ·2500 | 1·2 | ·1860 | 1·8 | 3·0 | 5·1 | 7 |
| Barley & Peas, | 1·12 | „ | .. | .. | .. | .. | ·1860 | 0·9 | ·1860 | 1·8 | 2·7 | 4·8 | 2 |
| Safflower, Carrots, | 0·20 | „ | .. | .. | .. | .. | ·1860 | 0·9 | ·1250 | 2·4 | 3·3 | 5·4 | 1 |
| Peas, | 1·25 | „ | .. | .. | .. | .. | ·1860 | 0·9 | ·1250 | 0·6 | 1·5 | 3·6 | 1 |
| Oats, | 1·43 | „ | .. | .. | .. | .. | ·1860 | 0·9 | ·1250 | 1·8 | 2·7 | 4·8 | 3 |
| Tobacco, | 0·13 | „ | .. | .. | .. | .. | ·1860 | 0·9 | ·1250 | 4·2 | 5·1 | 7·2 | 1 |
| Garden, | 0·34 | „ | .. | .. | .. | .. | ·1860 | 0·9 | ·1250 | 3·6 | 4·5 | 6·6 | 2 |
| | | | | | | | | | | | | | 52 |
| Wheat, | 0·66 | Kharif, | 1·95 | 5·84 | 11·5 | 2·0 | ·2500 | 2·50 | ·1860 | 5·7 | 8·2 | 10·2 | 9 |
| Gujai, | 3·00 | „ | .. | .. | .. | .. | ·2500 | 2·50 | ·1860 | 3·8 | 6·3 | 8·3 | 31 |
| Barley & Peas, | 0·23 | „ | .. | .. | .. | .. | ·1860 | 1·9 | ·1860 | 3·8 | 5·7 | 7·7 | 3 |
| | | | | | | | | | | | | | 43 |
| Wheat, | 5·20 | „ | 5·21 | 15·63 | 17·6 | 1·1 | ·2500 | 1·7 | ·1860 | 3·9 | 5·6 | 6·7 | 52 |
| Barley, | 3·91 | „ | .. | .. | .. | .. | ·2500 | 1·7 | ·1860 | 2·6 | 4·3 | 5·4 | 30 |
| Potatoes, | 1·31 | „ | .. | .. | .. | .. | ·1250 | 0·85 | ·0930 | 5·85 | 6·7 | 7·8 | 17 |
| | | | | | | | | | | | | | 109 |
| Nil. | .. | Sugar, | 12·4 | 12·4 | 14·2 | 1·1 | ·2500 | 2·3 | ·2500 | 9·2 | 11·5 | 12·6 | 143 |
| Garden, | 3·40 | Kharif, | 1·70 | 5·1 | 12·1 | 2·4 | ·1860 | 2·4 | ·1250 | 14·4 | 16·8 | 19·2 | 93 |
| Garden, | 2·40 | „ | 1·2 | 3·6 | 7·8 | 2·0 | ·1860 | 2·2 | ·1250 | 13·0 | 15·2 | 17·2 | 85 |
| Garden, | 1·25 | „ | 0·62 | 1·87 | 3·3 | 1·8 | ·1250 | 1·0 | ·0625 | 4·5 | 5·5 | 7·3 | 115 |
| Garden, | 0·25 | „ | 0·17 | 0·42 | 3·3 | 8·0 | ·1250 | 1·24 | ·0625 | 5·6 | 6·8 | 14·8 | 23 |
| Garden, | .. | Sugar, | 8·70 | 8·70 | 13·0 | 1·5 | ·2500 | 3·6 | ·2500 | 7·2 | 10·8 | 12·3 | 45 |
| Garden, | .. | „ | 4·25 | 4·25 | 6·5 | 1·5 | ·2500 | 3·6 | ·2500 | 7·2 | 10·8 | 12·3 | 45 |
| Tobacco, | 0·94 | Indian Corn, | 0·94 | 1·88 | 7·8 | 4·0 | ·1250 | 1·35 | ·0625 | 19·4 | 20·7 Sugar. | 24·7 | 75 |
| Wheat, | 13·70 | Sugar, | 1·41 | 15·11 | 10·8 | 0·7 | ·2500 | 4·1 | ·2500 | 12·3 | 16·4 | 17·1 | 17 |
| Tobacco, | 1·0 | Kharif, | 0·5 | 1·5 | 8·4 | 5·1 | ·1250 | 0·94 | ·0625 | 13 6 | 14·5 | 19·6 | 75 |
| Rabi, | 2·0 | Sugar, | 1·0 | 3·0 | 4·2 | 1·4 | ·2500 | 1·2 | ·2500 | 3·6 | 4·8 | 6·2 | 38 |
| Rabi, | 1·0 | „ | 0·9 | 2·7 | 2·6 | 1·0 | ·2500 | 1·6 | ·2500 | 4·8 | 6·4 | 7·4 | 31 |
| Tobacco, | 0·15 | Kharif, | 0·11 | 0·33 | 3·3 | 10·0 | ·1250 | 0·6 | ·0625 | 16·2 | 16·8 | 26·8 | 22 |
| Garden, | 0·07 | „ | .. | .. | .. | .. | ·1250 | 0·6 | ·0625 | 16·2 | 16·8 | 26·8 | 10 |
| | | | | | | | | | | | | | 32 |
| Tobacco, | 9·40 | „ | 4·70 | 14·10 | 71·0 | 5·0 | ·1250 | 1·0 | ·0930 | 14·2 | 15·2 | 20·2 | 117 |
| Wheat, | 0·63 | „ | 1·07 | 3·20 | 21·5 | 6·1 | ·2500 | 3·6 | ·1860 | 2·7 | 6·3 | 12·4 | 9 |
| Tobacco, | 1·50 | „ | .. | .. | .. | .. | ·1250 | 1·8 | ·0930 | 25·6 | 27·4 | 33 5 | 93 |
| | | | | | | | | | | | | | 102 |

TABLE G.—*Showing the cost of Irrigation per Acre of*

| District. | Number. | Class. | Labor. Class. | Labor. No. per well. | Depth to water surface. | Cost of lifting per day. | Depth of watering and cost per acre. ·1250. Days. | ·1250. Cost. | ·1860. Days. | ·1860. Cost. | ·2500. Days. | ·2500. Cost. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Bareilly—*(Continued)*, .. | 497 | Ráti, | Men, | 1 | 9 | 0-1-0 | 7·2 | 0·5 | 10·7 | 0·7 | 14·3 | 0·9 |
| Pillibhit, .. | 501 | Dhenkli, | „ | 3 | 15 | 0-8-0 | 15·8 | 8·0 | 23·8 | 12·0 | 31·7 | 16·0 |
| Shahjahanpur, .. | 517 | Lagor, | Cattle, | 2 | 33 | 0-7-6 | 3·1 | 1·5 | 4·6 | 2·2 | 6·1 | 3·0 |
| „ .. | 514 | „ | „ | 2 | 32 | 0-5-9 | 2·9 | 1·0 | 4·3 | 1·5 | 5·7 | 2·0 |
| „ .. | 505 | Coolie, | Men, | 6 | 30 | 0-8-3 | 3·4 | 1·7 | 5·0 | 2·6 | 6·8 | 3·4 |
| „ .. | 522 | Ráti, | „ | 1 | 24 | 0-1-0 | 6·6 | 0·66 | 9·8 | 0·98 | 13·1 | 1·3 |
| „ .. | 524 | „ | „ | 2 | 24 | 0-1-6 | 4·4 | 0·66 | 6·5 | 0·98 | 8·8 | 1·3 |
| „ .. | 520 | Dhenkli, | „ | 1 | 13 | 0-1-0 | 12·7 | 1·27 | 19·1 | 1·9 | 25·4 | 2·54 |
| OUDH. | | | | | | | | | | | | |
| Lucknow, .. | 578 | Lagor, | Cattle, | 4 | 32 | 0-8-6 | 4·8 | 1·95 | 7·2 | 2·5 | 9·5 | 3·9 |
| „ .. | 555 | Coolie, | Men, | 6 | 30 | 0-7-0 | 3·6 | 1·6 | 5·4 | 2·4 | 7·2 | 3·2 |
| „ .. | 552 | Lagor, | Cattle, | 3 | 22 | 0-6-6 | 5·0 | 2·0 | 7·5 | 3·0 | 10·0 | 4·0 |
| „ .. | 568 | Coolie, | Men, | 8 | 17 | 0-14-0 | 1·5 | 1·3 | 2·3 | 2·0 | 3·0 | 2·6 |
| Hardui, .. | 590 | „ | „ | 7 | 30 | 0-13-6 | 3·74 | 3·15 | 5·6 | 4·7 | 7·5 | 6·3 |
| „ .. | 588 | Lagor, | Cattle, | 6 | 25 | 0-12-1 | 3·9 | 3·0 | 6·0 | 4·6 | 7·9 | 6·0 |
| „ .. | 602 | Dhenkli, | Men, | 2 | 10 | 0-2-0 | 4·0 | 0·5 | 6·0 | 0·8 | 8·0 | 1·0 |
| „ .. | 605 | „ | „ | 1 | 9·5 | 0-1-0 | 8·9 | 0·9 | 13·4 | 1·4 | 17·8 | 1·8 |
| „ .. | 608<br>609 | Ráti, | „ | 3 | 10 | 0-2-0 | 4·1 | 0·5 | 6·2 | 0·8 | 8·2 | 1·0 |

*various Crops for a working day of* 9 *hours.*—(Continued).

| Command for the year. | | | | Total command, Acres. | Interest and Repairs. | | Cost of lifting per acre irrigated. | | | | | Total Cost per Acre. | No. of days required to irrigate command in Rabi. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Rabi.* | | *Kharif.* | | | Total per well. | Per acre irrigated. | *First Watering.* | | *After Waterings.* | | Total per Acre. | | |
| Crop. | Area. | Crop. | Area. | | | | Depth. | Cost. | Depth. | Cost. | | Rs. | |
| Garden, | 0·50 | Kharif, | 0·25 | 0·75 | 2·2 | 3·0 | ·1250 | 0·5 | ·0625 | 2·25 | 2·75 | 5·75 | 20 |
| .. | .. | Sugar, | 2·80 | 2·80 | 1·6 | 0·6 | ·1250 | 8·0 | ·1250 | 8·0 | 16·0 | 16·6 | 134 |
| Tobacco, | 2·30 | Kharif, | 1·15 | 3·45 | 19·6 | 5·1 | ·1250 | 1·5 | ·0930 | 20·9 | 22·4 | 27·5 | 108 |
| Barley, | 0·56 | ,, | 1·14 | 3·42 | 20·1 | 6·0 | ·1860 | 1·5 | ·1860 | 1·5 | 3·0 | 9·0 | 5 |
| Tobacco, | 1·72 | ,, | .. | .. | .. | .. | ·1250 | 1·0 | ·0930 | 14·2 | 15·2 | 21·2 | 76 |
| | | | | | | | | | | | | | 81 |
| | | | | | | | | | | | Sugar. | | |
| Wheat, | 4·50 | Sugar, | 2·44 | 6·94 | 6·2 | 0·9 | ·2500 | 3·4 | ·2500 | 3·4 | 6·8 | 7·7 | 34 |
| Garden, | 1·16 | Kharif, | 0·58 | 1·74 | 1·05 | 0·6 | ·1250 | 0·66 | ·0930 | 9·3 | 10·0 | 10·6 | 116 |
| Garden, | 2·32 | ,, | 1·16 | 3·48 | 2·1 | 0·6 | ·1250 | 0·66 | ·0930 | 9·3 | 10·0 | 10·6 | 158 |
| Garden, | 0·63 | ,, | 0·32 | 1·00 | 2·1 | 2·0 | ·1250 | 1·27 | ·0930 | 18·0 | 19·27 | 21·27 | 121 |
| Wheat, | 4·30 | Sugar, | 0·51 | 5·00 | 7·5 | 1·5 | ·2500 | 3·9 | ·1860 | 5·0 | 8·9 | 10·4 | 103 |
| Opium, | 0·18 | ,, | .. | .. | .. | .. | ·1860 | 2·5 | ·1860 | 9·75 | 12·2 | 13·7 | 6 |
| | | | | | | | | | | | | | 109 |
| Wheat, | 9·90 | Kharif, | 6·35 | 19·00 | 12·6 | 0·7 | ·2500 | 3·2 | ·1860 | 4·8 | 8·0 | 8·7 | 178 |
| Barley, | 2·13 | ,, | .. | .. | .. | .. | ·1860 | 2·4 | ·1860 | 2·4 | 4·8 | 5·5 | 23 |
| Opium, | 0·62 | ,, | .. | .. | .. | .. | ·1860 | 2·4 | ·1250 | 8·0 | 10·4 | 11·1 | 14 |
| | | | | | | | | | | | | | 215 |
| Wheat, | 3·76 | ,, | 1·88 | 5·64 | 5·4 | 1·0 | ·2500 | 4·0 | ·1860 | 6·0 | 10·0 | 11·0 | 95 |
| Wheat, | 9·0 | ,, | 8·22 | 24·60 | 12·6 | 0·5 | ·2500 | 2·6 | ·1860 | 4·0 | 6·6 | 7·1 | 70 |
| Barley, | 5·28 | ,, | .. | .. | .. | .. | ·1860 | 2·0 | ·1860 | 2·0 | 4·0 | 4·5 | 25 |
| Opium, | 2·10 | ,, | .. | .. | .. | .. | ·1860 | 2·0 | ·1250 | 6·5 | 8·5 | 9·0 | 20 |
| | | | | | | | | | | | | | 210 |
| Wheat, | 7·0 | ,, | 3·5 | 10·5 | 7·15 | 0·7 | ·2500 | 6·3 | ·1860 | 4·7 | 11·0 | 11·7 | 92 |
| Wheat, | 5·30 | Sugar, | 2·0 | 7·30 | 12·6 | 1·7 | ·2500 | 6·0 | ·1860 | 4·6 | 10·6 | 12·3 | 75 |
| Wheat, | 3·50 | Kharif, | 1·75 | 8·25 | 3·2 | 0·4 | ·2500 | 1·0 | ·1860 | 0·8 | 1·8 | 2·2 | 50 |
| Barley, | 1·25 | ,, | 1·19 | 3·57 | 1·6 | 0·4 | ·1860 | 1·4 | ·1860 | 1·4 | 2·8 | 3·2 | 34 |
| Opium, | 1·13 | ,, | .. | .. | .. | .. | ·1860 | 1·4 | ·1250 | 3·6 | 5·0 | 5·4 | 59 |
| | | | | | | | | | | | | | 93 |
| Wheat, | 4·16 | ,, | 2·08 | 6·24 | 4·2 | 0·7 | ·2500 | 1·0 | ·1860 | 0·8 | 1·8 | 2·5 | 61 |

ABSTRACT TABLE G.—*Showing the Mean Cost of Lifting Water*

| District. | Class. | Labor. | Mean depth to water surface. | RABI. | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Wheat. | Wheat and Barley. | Wheat and Gram. | Barley. | Barley and Gram. | Barley and Peas. | Safflower. | Safflower and Gram. | Safflower and Carrots. | Gram. |
| Cawnpore, .. | Lagor, | Cattle, | 32 | 10·15 | 7·6 | .. | .. | .. | .. | .. | .. | .. | .. |
| Hamirpur, .. | ,, | ,, | 40 | .. | .. | .. | 11·4 | .. | .. | .. | .. | .. | .. |
| Farukhabad, .. | ,, | ,, | 47 | 12·7 | 9·6 | .. | 6·0 | .. | .. | .. | .. | .. | .. |
| Mainpuri, .. | ,, | ,, | 20 | 7·0 | 7·0 | 6·9 | 4·6 | 5·0 | .. | .. | .. | .. | 2·2 |
| Etah, .. | ,, | ,, | 17 | 7·0 | 6·3 | .. | 4·2 | .. | .. | .. | .. | .. | .. |
| Muttra, .. | ,, | ,, | 62 | 19·1 | .. | .. | 13·2 | .. | .. | .. | .. | 16·0 | .. |
| Saharanpur, .. | ,, | ,, | 17 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Shahjahanpur, .. | ,, | ,, | 32 | .. | .. | .. | 3·0 | .. | .. | .. | .. | .. | .. |
| Lucknow, .. | ,, | ,, | 27 | 9·4 | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Hardui, .. | ,, | ,, | 25 | 10·6 | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Mean, .. | ,, | ,, | 32 | 10·6 | 7·6 | 6·9 | 7·0 | 5·0 | .. | .. | .. | 16·0 | 2·2 |
| Shahjahanpur, .. | ,, | Men, | 30 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Lucknow, .. | ,, | ,, | 23 | 7·3 | .. | .. | 4·4 | .. | .. | .. | .. | .. | .. |
| Hardui, .. | ,, | ,, | 30 | 11·0 | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Mean, .. | ,, | ,, | 27 | 9·2 | .. | .. | 4·4 | .. | .. | .. | .. | .. | .. |
| Mainpuri, .. | Kili, | Cattle, | 23 | 8·1 | .. | .. | 4·8 | .. | .. | .. | .. | .. | .. |
| Etah, .. | ,, | ,, | 20 | 2·6 | .. | .. | 1·6 | .. | .. | .. | .. | .. | .. |
| Aligarh, .. | ,, | ,, | 28 | 6·6 | 4·4 | .. | 4·2 | .. | 4·2 | 3·9 | 2·1 | 5·0 | 1·4 |
| Muttra, .. | ,, | ,, | 61 | 12·0 | 8·8 | 8·0 | 6·6 | 4·0 | 5·1 | .. | .. | 8·3 | .. |
| Bulandshahr, .. | ,, | ,, | 24 | 7·0 | 8·0 | 7·0 | 5·4 | .. | .. | 5·7 | 4·1 | .. | 3·6 |
| Meerut, .. | ,, | ,, | 26 | 6·7 | 4·6 | 6·7 | 4·8 | .. | 4·3 | .. | .. | 3·3 | 1·6 |
| Muzaffarnagar, .. | ,, | ,, | 15 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Bijnor, .. | ,, | ,, | 16 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Moradabad, .. | ,, | ,, | 19 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Bareilly, .. | ,, | ,, | 32 | 6·3 | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Mean, .. | ,, | ,, | 27 | 7·0 | 6·3 | 7·2 | 4·6 | 4·0 | 4·4 | 4·8 | 3·1 | 5·5 | 3·3 |
| Farukhabad, .. | Dhenkli, | Men, | 16 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Bijnor, .. | ,, | ,, | 20 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |

*per acre irrigated in Rupees for various Crops, Districts and Lifts.*

| Rabi. | | | | | | | | Kharif. | | | | | Remarks. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Carrots. | Peas. | Oats. | Opium. | Tobacco. | Potatoes. | Garlic. | Garden. | Sugar. | Cotton. | Indian Corn. | Millet. | Indigo. | |
| .. | .. | .. | .. | 21·3 | 20·4 | .. | 20·0 | .. | .. | .. | .. | .. | Tobacco and Potatoe crops, high class. |
| .. | .. | .. | .. | 9·1 | .. | .. | .. | .. | | | | | |
| .. | .. | .. | 16·6 | 14·9 | 11·0 | .. | .. | .. | | | | | |
| 13·4 | .. | .. | 16·4 | 12·1 | 5·6 | .. | 14·9 | .. | | | | | |
| 12·5 | .. | .. | 16·2 | .. | .. | .. | .. | .. | | | | | |
| .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | Safflower, subsidiary crop. |
| .. | .. | .. | .. | .. | .. | .. | 16·0 | .. | | | | | |
| .. | .. | .. | .. | 18·8 | .. | .. | .. | .. | | | | | |
| .. | .. | .. | 12·2 | .. | .. | .. | .. | .. | | | | | |
| .. | .. | .. | .. | .. | .. | .. | .. | .. | | | | | |
| 12·9 | .. | .. | 15·3 | 15·2 | 12·3 | .. | 17·0 | .. | | | | | |
| .. | .. | .. | .. | .. | .. | .. | .. | 6·8 | | | | | |
| .. | .. | .. | 9·5 | .. | .. | .. | .. | .. | | | | | |
| .. | .. | .. | .. | .. | .. | .. | .. | .. | | | | | |
| .. | .. | .. | 9·5 | .. | .. | .. | .. | 6·8 | | | | | |
| .. | .. | .. | .. | .. | .. | .. | .. | .. | | | | | |
| .. | .. | 4·8 | .. | .. | .. | .. | .. | .. | | | | | |
| 7·2 | 2·8 | 4·8 | 7·4 | 8·7 | 6·1 | 14·0 | 6·3 | .. | .. | .. | .. | .. | Carrots, subsidiary crop. |
| .. | .. | .. | .. | .. | .. | .. | 17·0 | .. | .. | .. | .. | .. | Wells deep. |
| .. | 3·3 | 5·1 | .. | 12·4 | .. | .. | 9·5 | .. | | | | | |
| .. | 2·1 | 2·7 | .. | 5·1 | 8·5 | .. | 7·2 | .. | | | | | |
| .. | .. | .. | .. | .. | .. | .. | .. | 9·2 | | | | | |
| .. | .. | .. | .. | .. | .. | .. | .. | 7·2 | | | | | |
| .. | .. | .. | .. | 16·0 | .. | .. | .. | 12·3 | | | | | |
| .. | .. | .. | .. | 19·6 | .. | .. | .. | .. | .. | .. | .. | .. | Tobacco, high class |
| 7·2 | 2·7 | 4·3 | 7·4 | 12·4 | 7·3 | 14·0 | 10·0 | 9·2 | | | | | |
| .. | .. | .. | .. | .. | .. | .. | 6·9 | .. | | | | | |
| .. | .. | .. | .. | .. | .. | .. | 5·1 | .. | | | | | |

ABSTRACT TABLE G.—*Showing the Mean Cost of Lifting Water*

| District. | Class. | Labor. | Mean depth to water surface. | RABI. | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Wheat. | Wheat and Barley. | Wheat and Gram. | Barley. | Barley and Gram. | Barley and Peas. | Safflower. | Safflower and Gram. | Safflower and Carrots. | Gram. |
| Moradabad, .. | Dhenkli, | Men, | 15 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Pillibhit, .. | „ | „ | 15 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Shahjahanpur, .. | „ | „ | 13 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Hardui, .. | „ | „ | 10 | 1·8 | .. | .. | 2·8 | .. | .. | .. | .. | .. | .. |
| Mean, .. | „ | „ | 15 | 1·8 | .. | .. | 2·8 | .. | .. | .. | .. | .. | .. |
| Bareilly, .. | Ráti, | „ | 9 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Rampur, .. | „ | „ | 21 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Shahjahanpur, .. | „ | „ | 24 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Hardui, .. | „ | „ | 10 | 1·8 | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Mean, .. | „ | „ | 16 | 1·8 | .. | .. | .. | .. | .. | .. | .. | .. | .. |

*per acre irrigated in Rupees for various Crops, Districts and Lifts*—(Continued).

| Rabi. | | | | | | | | Kharif. | | | | | Remarks. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Carrots. | Peas. | Oats. | Opium. | Tobacco. | Potatoes. | Garlic. | Garden. | Sugar. | Cotton. | Indian Corn. | Millet. | Indigo. | |
| .. | .. | .. | .. | .. | .. | .. | .. | 4·2 | | | | | |
| .. | .. | .. | .. | .. | .. | .. | .. | 16·0 | .. | .. | .. | .. | Sugar, only one example, hired labor. |
| .. | .. | .. | .. | .. | .. | .. | 19·27 | .. | .. | .. | .. | .. | Garden watered 20 times. |
| .. | .. | .. | 5·0 | .. | .. | .. | .. | .. | .. | .. | .. | .. | Barley and wheat on different wells. |
| .. | .. | .. | 5·0 | .. | .. | .. | 10·4 | 10·1 | | | | | |
| .. | .. | .. | .. | .. | .. | .. | 2·75 | .. | | | | | |
| .. | .. | .. | .. | 16·8 | .. | .. | 16·8 | .. | .. | .. | .. | .. | Garden and tobacco watered 28 times. |
| .. | .. | .. | .. | .. | .. | .. | 10·0 | .. | | | | | |
| .. | .. | .. | .. | .. | .. | .. | .. | .. | | | | | |
| .. | .. | .. | .. | 16·8 | .. | .. | 9·9 | .. | | | | | |

TABLE H.—*Showing the mean cost of watering the classes of Crops commonly irrigated in each District, and the mean rate per acre for a pucka or masonry well, except in the case of Bijnor, and of Dhenklis and Rátis which have kucha wells. Figures above Depth in After Waterings show number given.*

| District. | Class. | Mean depth to W.S. | Usual Labor and Cost per day per Lift. | | | Cost for one acre per Lift at a depth of | | | Mean interest and annual charge per acre for a masonry well. | Wheat. | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | *First Watering.* | | *After Watering.* | | |
| | | | Cattle No. | Men No. | Cost Rs. | ·1250. | ·1860. | ·2500. | | Depth. | Cost Rs. | Depth. | Cost Rs. | Total Cost. |
| Cawnpore, ... | Lagor, | 47 | 2 | 3 | 0-5-6 | 2·0 | 3·0 | 4·0 | 3·0 | ·2500 | 4·0 | (2) ·1860 | 6·0 | 10·0 |
| Hamirpur, ... | „ | 40 | 2 | 3 | 0-5-0 | 1·5 | 2·2 | 3·0 | 3·0 | ... | ... | ... | ... | ... |
| Farukhabad, ... | „ | 47·5 | 2 | 3 | 0-5-6 | 1·7 | 2·4 | 3·3 | 2·5 | ·2500 | 3·3 | (3) ·1860 | 7·2 | 10·5 |
| Mainpuri, ... | „ | 20 | 2 | 3 | 0-5-6 | 1·4 | 2·1 | 2·8 | 2·0 | ·2500 | 2·8 | (2) ·1860 | 4·2 | 7·0 |
| Etah, ... | „ | 17·8 | 2 | 3 | 0-5-6 | 1·7 | 2·6 | 3·5 | 2·0 | ·2500 | 3·5 | (3) ·1860 | 7·8 | 11·3 |
| Saharanpur, ... | „ | 23 | 3 | 3 | 0-5-0 | 1·25 | 1·9 | 2·5 | 2·0 | ... | ... | ... | ... | ... |
| Shahjahanpur, ... | „ | 34·5 | 2 | 3 | 0-5-6 | 1·0 | 1·5 | 2·0 | 4·0 | ·2500 | 2·0 | ... | ... | 2·0 |
| Lucknow, ... | „ | 31 | 4 | 4 | 0-10-0 | 3·1 | 4·6 | 6·2 | ... | ·2500 | 6·2 | (2) ·1860 | 9·2 | 15·4 |
| Mean, ... | „ | 32 | ... | ... | ... | 1·9 | 2·8 | 3·8 | 2·6 | ... | ... | ... | ... | 9·4 |
| Mean, ... | Coolie, | 33 | ... | 8 | 0-10-0 | 2·2 | 3·3 | 4·4 | ... | ... | ... | ... | ... | 11·0 |
| | | | | | | Omitted. | | | | | | | | |
| Mainpuri, ... | Kili, | 30 | 4 | 5 | 0-11-0 | 2·0 | 30 | 4·0 | 2·0 | ·2500 | 4·0 | (2) ·1860 | 6·0 | 10·0 |
| Etah, ... | „ | 22 | 4 | 5 | 0-11-0 | 1·0 | 1·5 | 2·0 | 2·0 | ·2500 | 2·0 | (3) ·1860 | 4·5 | 6·5 |
| Aligarh, ... | „ | 28 | 4 | 4 | 0-10-6 | 1·05 | 1·6 | 2·1 | 1·8 | ·2500 | 2·1 | (3) ·1860 | 4·8 | 6·9 |
| Muttra, ... | „ | 61 | 4 | 5 | 0-10-6 | 1·3 | 2·0 | 2·7 | 4·0 | ·2500 | 2·7 | (3) ·1860 | 6·0 | 8·7 |
| Bulandshahr, ... | „ | 24·3 | 4 | 4 | 0-10-0 | 1·2 | 1·8 | 2·5 | 1·5 | ·2500 | 2·5 | (3) ·1860 | 5·4 | 7·9 |
| Meerut, ... | „ | 26·4 | 4 | 4 | 1-10-0 | 1·1 | 1·6 | 2·2 | 1·8 | ·2500 | 2·2 | (3) ·1860 | 4·8 | 7·0 |
| Muzaffarnagar, ... | „ | 18·8 | 8 | 5 | 1-0-0 | 1·15 | 1·7 | 2·3 | 1·1 | ·2500 | 2·3 | (3) ·1860 | 5·1 | 7·4 |
| Bijnor, ... | „ | 17 | 8 | 6 | 1-1-0 | 1·8 | 2·7 | 3·6 | Kacha 1·5 Packa 4·0 | ... | ... | ... | ... | ... |
| Moradabad, ... | „ | 19·5 | 4 | 4 | 0-9-6 | 1·3 | 1·9 | 2·6 | 4·0 | ·2500 | 2·6 | ... | ... | 2·6 |
| Bareilly, ... | „ | 41 | 2 | 3 | 0-5-0 | 0·9 | 1·3 | 1·7 | 5·0 | ·2500 | 1·7 | (1) ·1860 | 1·3 | 3·0 |
| Mean, ... | „ | 30 | ... | ... | ... | 1·2 | 1·8 | 2·4 | 2·6 | ... | ... | ... | ... | 7·0 |
| Hardui, ... | Dhenkli, | 10 | ... | 2 | 0-1-0 | 0·6 | 0·9 | 1·2 | 0·4 | ·2500 | 1·2 | (1) ·1860 | 0·9 | 2·1 |
| Farukhabad, ... | „ | 16 | ... | 2 | 0-1-0 | 0·6 | 0·9 | 1·2 | 1·8 | ·2500 | 1·2 | (3) ·1860 | 2·7 | 3·9 |
| Bijnor, ... | „ | 21 | ... | 2 | 0-1-0 | 1·0 | 1·5 | 2·0 | 1·4 | ... | ... | ... | ... | ... |
| Moradabad, ... | „ | 13·3 | ... | 1·5 | 0-1-0 | 0·5 | 0·8 | 1·0 | 0·4 | ·2500 | 1·0 | ... | ... | 1·0 |
| Pillibhit, ... | „ | 17 | ... | 1·5 | 0-1-0 | 3·0 | 4·5 | 6·0 | 0·6 | ... | ... | ... | ... | ... |
| Shahjahanpur, ... | „ | 14 | ... | 2 | 0-1-0 | 0·8 | 1·2 | 1·6 | 0·6 | ·2500 | 1·2 | ... | ... | 1·2 |
| Mean, ... | „ | 15 | ... | ... | ... | 0·7 | 1·05 | 1·4 | 0·7 | ... | ... | ... | ... | 2·1 |
| Rampur, ... | Ráti, | 22 | ... | 2 | 0-1-0 | 0·6 | 1·0 | 1·3 | 2·0 | ... | ... | ... | ... | ... |
| Bareilly, ... | „ | 10 | ... | 2 | 0-1-0 | 0·5 | 0·7 | 1·0 | 0·7 | ·2500 | 1·0 | (1) ·1860 | 0·7 | 1·7 |
| Shahjahanpur, ... | „ | 25 | ... | 2 | 0-1-0 | 0·5 | 0·7 | 1·0 | 0·6 | ·2500 | 1·0 | ... | ... | 1·0 |
| Hardui, ... | „ | 10 | ... | 2 | 0-1-0 | 0·7 | 1·1 | 1·4 | 0·4 | ·2500 | 1·4 | (1) ·1860 | 1·1 | 2·5 |
| Mean, ... | „ | 17 | ... | ... | ... | 0·6 | 0·9 | 1·2 | 0·9 | ... | ... | ... | ... | 2·0 |

TABLE H.—*Showing the Mean Cost of Watering the classes of Crops commonly irrigated in each District, and the Mean rate per acre for a pucka or masonry well, except in the case of Bijnor, and of Dhenklis and Rátis which have kucha wells. Figures above Depth in After Waterings show number given*—(Continued).

| WHEAT AND BARLEY. | | | | | WHEAT AND GRAM. | | | | | BARLEY. | | | | | BARLEY AND GRAM. | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *First Watering.* | | *After Watering.* | | | *First Watering.* | | *After Watering.* | | | *First Watering.* | | *After Watering.* | | | *First Watering* | | *After Watering.* | | |
| Depth. | Cost Rs. | Depth. | Cost Rs. | Total Cost. | Depth. | Cost Rs. | Depth. | Cost Rs. | Total Cost. | Depth. | Cost Rs. | Depth. | Cost Rs. | Total Cost. | Depth. | Cost Rs. | Depth. | Cost Rs. | Total Cost. |
| ·1860 | 3·0 | (2) ·1860 | 6·0 | 9·0 | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| ·2500 | 3·0 | (2) ·1860 | 4·4 | 7·4 | ... | ... | ... | ... | ... | ·1860 | 2·2 | (5) ·1860 | 11·0 | 13·2 | ... | ... | ... | ... | ... |
| ·2500 | 3·3 | (2) ·1860 | 4·8 | 8·1 | ... | ... | ... | ... | ... | ·1860 | 2·4 | (1) ·1860 | 2·4 | 4·8 | ... | ... | ... | ... | ... |
| ·1860 | 2·1 | (2) ·1860 | 4·2 | 6·3 | ·1860 | 2·1 | (2) ·1860 | 4·2 | 6·3 | ·1860 | 2·1 | (1) ·1860 | 2·1 | 4·2 | ·1860 | 2·1 | (1) ·1860 | 2·1 | 4·2 |
| ·1860 | 2·6 | ·1860 | 5·2 | 7·8 | ... | ... | ... | ... | ... | ·1860 | 2·6 | (1) ·1860 | 2·6 | 5·2 | ... | ... | ... | ... | ... |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ·1860 | 1·5 | (1) ·1860 | 7·5 | 3·0 | ... | ... | ... | ... | ... |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ·1860 | 4·6 | (1) ·1860 | 4·6 | 9·2 | ... | ... | ... | ... | ... |
| ... | ... | ... | ... | 7·7 | ... | ... | ... | ... | 6·3 | ... | ... | ... | ... | 5·3 | ... | ... | ... | ... | 4·2 |
| ... | ... | ... | ... | 9·0 | ... | ... | ... | ... | 7·4 | ... | ... | ... | ... | 6·2 | ... | ... | ... | ... | 4·9 |
| ·1860 | 3·0 | (2) ·1860 | 6·0 | 9·0 | ·1860 | 3·0 | (2) ·1860 | 6·0 | 9·0 | ·1860 | 3·0 | (1) ·1860 | 3·0 | 6·0 | ·1860 | 3·0 | (1) ·1860 | 3·0 | 6·0 |
| ·1860 | 1·5 | (2) ·1860 | 3·0 | 4·5 | ... | ... | ... | ... | ... | ·1860 | 1·5 | (1) ·1860 | 1·5 | 3·0 | ... | ... | ... | ... | ... |
| ·1860 | 1·6 | (2) ·1860 | 3·2 | 4·8 | ... | ... | ... | ... | ... | ·1860 | 1·6 | (2) ·1860 | 3·2 | 4·8 | ... | ... | ... | ... | ... |
| ·1860 | 2·0 | (3) ·1860 | 6·0 | 8·0 | ·1860 | 2·0 | (3) ·1860 | 6·0 | 8·0 | ·1860 | 2·0 | (2) ·1860 | 4·0 | 6·0 | ·1860 | 2·0 | (2) ·1860 | 4·0 | 6·0 |
| ·1860 | 1·8 | (3) ·1860 | 5·4 | 7·2 | ·1860 | 1·8 | (2) ·1860 | 3·6 | 5·4 | ·1860 | 1·8 | (2) ·1860 | 3·6 | 5·4 | ... | ... | ... | ... | ... |
| ·1860 | 1·6 | (2) ·1860 | 3·2 | 4·8 | ·1860 | 1·6 | (3) ·1860 | 4·8 | 6·4 | ·1860 | 1·6 | (2) ·1860 | 3·2 | 4·8 | ... | ... | ... | ... | ... |
| ... | .. | ... | ... | ... | ... | ... | ... | ... | .. | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| ... | ... | ... | ... | 6·4 | ... | ... | ... | ... | 6·4 | ... | ... | ... | ... | 5·0 | ... | ... | ... | ... | 5·0 |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ·1860 | 0·9 | ·1860 | 0·9 | 1·8 | ... | ... | ... | ... | ... |
| ·2500 | 1·2 | (2) ·1860 | 1·8 | 3·0 | ... | ... | ... | ... | ... | ·1860 | 0·9 | ·1860 | 0·9 | 1·8 | ... | .. | ... | ... | ... |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ·1860 | 1·2 | (1) ·1860 | 1·2 | 2·4 | ... | ... | ... | ... | ... |
| ... | ... | ... | ... | 3·0 | ... | ... | ... | ... | ... | ... | ... | ... | ... | 2·0 | ... | ... | ... | ... | .. |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ·1860 | 0·7 | (1) ·1860 | 0·7 | 1·4 | ... | ... | ... | ... | ... |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ·1860 | 1·1 | (1) ·1860 | 1·1 | 2·2 | ... | ... | ... | ... | ... |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | 1·8 | ... | ... | ... | ... | ... |

TABLE H.—*Showing the Mean Cost of Watering the classes of Crops commonly irrigated in each District, and the Mean rate per acre for a pucka or masonry well, except in the case of Bijnor, and of Dhenklis and Rátis which have kucha wells. Figures above Depth in After Waterings show number given*—(Continued).

| BARLEY AND PEAS. | | | | | SAFFLOWER. | | | | | SAFFLOWER AND CARROTS. | | | | | GRAM. | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *First Watering.* | | *After Watering.* | | | *First Watering.* | | *After Watering.* | | | *First Watering.* | | *After Watering.* | | | *First Watering.* | | *After Watering.* | | |
| Depth. | Cost Rs. | Depth. | Cost Rs. | Total Cost. | Depth. | Cost Rs. | Depth. | Cost Rs. | Total Cost. | Depth. | Cost Rs. | Depth. | Cost Rs. | Total Cost. | Depth. | Cost Rs. | Depth. | Cost Rs. | Total Cost. |
| ·1860 | 3·0 | (2) ·1860 | 6·0 | 9·0 | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ·1860 | 2·1 | ... | ... | 2·1 |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | .. | ... | ... | ... |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | 2·1 |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | 2·5 |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ·1860 | 3·0 | ... | ... | 3·0 |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| ·1860 | 1·6 | (2) ·1860 | 3·2 | 4·8 | ·1860 | 1·6 | (2) ·1250 | 2·1 | 3·7 | ·1860 | 1·6 | (3) ·1250 | 3·15 | 4·75 | ·1860 | 1·6 | ... | ... | 1·6 |
| ·1860 | 2·0 | (1) ·1860 | 2·0 | 4·0 | ... | ... | ... | ... | ... | ·1860 | 2·0 | (4) ·1250 | 5·2 | 7·2 | ... | ... | ... | ... | ... |
| ·1860 | 1·8 | (2) ·1860 | 3·6 | 5·4 | ·1860 | 1·8 | (2) ·1250 | 2·4 | 4·2 | ... | ... | ... | ... | ... | ·1860 | 1·8 | (1 ·1860 | 1·8 | 3·6 |
| ·1860 | 1·6 | (2) ·1860 | 3·2 | 4·8 | ... | ... | ... | ... | ... | ·1860 | 1·6 | (4) ·1250 | 4·4 | 6·0 | ·1860 | 1·6 | ... | ... | 1·6 |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | .. | ... | ... | ... | ... | ... | ... | ... |
| ... | ... | ... | ... | 5·0 | ... | ... | ... | ... | 4·0 | ... | ... | ... | ... | 6·0 | .. | ... | ... | ... | 2·5 |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |

TABLE H.—*Showing the mean cost of watering the classes of Crops commonly irrigated in each District, and the mean rate per acre for a pucka or masonry well, except in the case of Bijnor, and of Dhenklis and Rátis which have kucha wells. Figures above Depth in After Waterings show number given*—(Continued).

| CARROTS. | | | | | PEAS. | | | | | OATS. | | | | | OPIUM. | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *First Watering.* | | *After Watering.* | | | *First Watering.* | | *After Watering.* | | | *First Watering.* | | *After Watering.* | | | *First Watering.* | | *After Watering.* | | |
| Depth. | Cost Rs. | Depth. | Cost Rs. | Total Cost. | Depth. | Cost Rs. | Depth. | Cost Rs. | Total Cost. | Depth. | Cost Rs. | Depth. | Cost Rs. | Total Cost. | Depth. | Cost Rs. | Depth. | Cost Rs. | Total Cost. |
| | | | | | | | | | | | | | | | | | (5) | | |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ·1860 | 3·0 | ·1250 | 10·0 | 13·0 |
| | | | | | | | | | | | | | | | | | (9) | | |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ·1860 | 2·2 | ·1250 | 10·5 | 12·7 |
| | | | | | | | | | | | | | | | | | (7) | | |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ·1860 | 2·4 | ·1250 | 11·9 | 14·8 |
| | | (9) | | | | | | | | | | | | | | | (9) | | |
| ·1860 | 2·1 | ·1250 | 12·6 | 14·7 | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ·1860 | 2·1 | ·1250 | 12·6 | 14·7 |
| | | (9) | | | | | | | | | | (5) | | | | | | | |
| ·1860 | 2·6 | ·1250 | 15·3 | 17·9 | ... | ... | ... | ... | ... | ·1860 | 2·6 | ·1860 | 13·0 | 15·6 | ·1860 | 2·6 | ·1250 | 15·3 | 17·9 |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| | | | | | | | | | | | | | | | | | (5) | | |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ·1860 | 4·6 | ·1250 | 15·5 | 20·1 |
| ... | ... | ... | ... | 16·3 | ... | ... | ... | ... | ... | ... | ... | ... | ... | 15·6 | ... | ... | ... | ... | 14·5 |
| ... | ... | ... | ... | 19·0 | ... | ... | ... | ... | ... | ... | ... | ... | ... | 18·2 | ... | ... | ... | ... | 16·9 |
| | | (9) | | | | | | | | | | | | | | | (9) | | |
| ·1860 | 3·0 | ·1250 | 18·0 | 21·0 | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ·1860 | 3·0 | ·1250 | 18·0 | 21·0 |
| | | (9) | | | | | | | | | | (5) | | | | | (9) | | |
| ·1860 | 1·5 | ·1250 | 9·0 | 10·5 | ... | ... | ... | ... | ... | ·1860 | 1·5 | ·1860 | 7·5 | 9·0 | ·1860 | 1·5 | ·1250 | 9·0 | 10·5 |
| | | (4) | | | | | (1) | | | | | (5) | | | | | (9) | | |
| ·1860 | 1·6 | ·1250 | 4·2 | 5·8 | ·1860 | 1·6 | ·1250 | 1·05 | 1·65 | ·1860 | 1·6 | ·1860 | 8·0 | 9·6 | ·1860 | 1·6 | ·1250 | 13·4 | 15·0 |
| | | | | | | | | | | | | (5) | | | | | | | |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ·1860 | 2·0 | ·1860 | 10·0 | 12·0 | ... | ... | ... | ... | ... |
| | | | | | | | (1) | | | | | (5) | | | | | | | |
| ... | ... | ... | ... | ... | ·1860 | 1·8 | ·1250 | 1·2 | 3·0 | ·1860 | 2·8 | ·1860 | 6·0 | 7·8 | ... | ... | ... | ... | ... |
| | | (5) | | | | | (1) | | | | | (3) | | | | | | | |
| ·1860 | 1·6 | ·1250 | 5·5 | 7·1 | ·1860 | 1·6 | ·1250 | 1·1 | 2·7 | ·1860 | 1·6 | ·1860 | 4·8 | 6·4 | ... | ... | ... | ... | ... |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | .. | ... | ... | ... | ... |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| ... | | ... | ... | ... | ... | | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| ... | ... | ... | ... | 8·0 | ... | ... | ... | ... | 2·5 | ... | ... | ... | ... | 9·0 | ... | ... | ... | ... | 13·0 |
| | | | | | | | | | | | | | | | | | (4) | | |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ·1860 | 0·9 | ·1250 | 2·4 | 3·3 |
| | | | | | | | | | | | | | | | | | (7) | | |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ·1860 | 0·9 | ·1250 | 4·2 | 5·1 |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| ... | ... | ... | ... | 4·2 | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| ... | ... | ... | ... | .. | .. | .. | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ·1860 | 1·1 | (4) ·1250 | 2·8 | 3·9 |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | 4·0 |

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| TOBACCO. | | | | | POTATOES. | | | | | GARDEN. | | | | | SUGAR. | | | | | Remarks. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *First Watering.* | | *After Watering.* | | | *First Watering.* | | *After Watering.* | | | *First Watering.* | | *After Watering.* | | | *First Watering.* | | *After Watering.* | | | |
| Depth. | Cost Rs. | Depth. | Cost Rs. | Total Cost. | Depth. | Cost Rs. | Depth. | Cost Rs. | Total Cost. | Depth. | Cost Rs. | Depth. | Cost Rs. | Total Cost. | Depth. | Cost Rs. | Depth. | Cost Rs. | Total Cost. | |
| | | (11) | | | | | (11) | | | | | (9) | | | | | | | | |
| ·1860 | 3·0 | ·1250 | 22·0 | 25·0 | ·1250 | 2·0 | ·1250 | 22·0 | 24·0 | ·1250 | 2·0 | ·1250 | 18·0 | 20·0 | ... | ... | ... | ... | ... | |
| | | (5) | | | | | | | | | | (9) | | | | | (5) | | | |
| ·1860 | 2·2 | ·1250 | 7·5 | 9·7 | ... | ... | ... | ... | ... | ·1250 | 1·5 | ·1250 | 13·5 | 15·0 | ·2500 | 3·0 | ·1860 | 11·0 | 14·0 | |
| | | (9) | | | | | (9) | | | | | (11) | | | | | | | | |
| ·1860 | 2·4 | ·1250 | 15·3 | 17·7 | ·1250 | 1·7 | ·0930 | 10·8 | 12·5 | ·1250 | 1·7 | ·1250 | 18·7 | 20·4 | ... | ... | ... | ... | ... | |
| | | (9) | | | | | (9) | | | | | (9) | | | | | (3) | | | |
| ·1860 | 2·1 | ·1250 | 12·6 | 14·7 | ·1250 | 1·4 | ·0930 | 9·4 | 10·8 | ·1250 | 1·4 | ·1250 | 12·6 | 14·0 | ·2500 | 2·8 | ·2500 | 8·4 | 11·2 | |
| | | (9) | | | | | | | | | | (9) | | | | | (3) | | | |
| ·1860 | 2·6 | ·1250 | 15·3 | 17·9 | ... | ... | ... | ... | ... | ·1250 | 1·7 | ·1250 | 15·3 | 17·0 | ·2500 | 3·5 | ·2500 | 10·5 | 14·0 | |
| | | | | | | | | | | | | (9) | | | | | | | | |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ·1860 | 1·9 | ·1250 | 11·2 | 13·1 | ... | ... | ... | ... | ... | |
| | | (9) | | | | | | | | | | (9) | | | | | (1) | | | |
| ·1250 | 1·0 | ·0930 | 9·2 | 10·2 | ... | ... | ... | ... | ... | ·1250 | 1·0 | ·0930 | 9·2 | 10·2 | ·2500 | 2·0 | ·2500 | 2·0 | 4·0 | |
| | | | | | | | (8) | | | | | (4) | | | | | (9) | | | |
| ... | ... | ... | ... | ... | ·1250 | 3·1 | ·0930 | 18·4 | 21·5 | ·1860 | 4·6 | ·1250 | 12·4 | 17·0 | ·1860 | 4·6 | ·0960 | 20·7 | 25·3 | Sugar in ridges. |
| | | | | | | | | Assumed. | | | | | | | | | | | | |
| ... | ... | ... | ... | 14·0 | ... | ... | ... | ... | 14·0 | ... | ... | ... | ... | 15·8 | ... | ... | ... | ... | 14·0 | |
| ... | .. | ... | ... | 16·3 | ... | ... | ... | ... | 16·3 | ... | ... | ... | ... | 18·5 | ... | ... | ... | ... | 16·3 | Mean. |
| | | (9) | | | | | (9) | | | | | (9) | | | | | (3) | | | |
| ·1860 | 3·0 | ·1250 | 18·0 | 21·0 | ·1250 | 2·0 | ·0930 | 13·5 | 15·5 | ·1250 | 2·0 | ·1250 | 18·0 | 20·0 | ·2500 | 4·0 | ·2500 | 12·0 | 16·0 | |
| | | (9) | | | | | | | | | | (9) | | | | | (3) | | | |
| ·1860 | 1·5 | ·1250 | 9·0 | 10·5 | ... | ... | ... | ... | ... | ·1250 | 1·0 | ·1250 | 9·0 | 10·0 | ·2500 | 2·0 | ·2500 | 6·0 | 8·0 | |
| | | (9) | | | | | (3) | | | | | (6) | | | | | | | | |
| ·1860 | 1·6 | ·1250 | 13·4 | 15·0 | ·1860 | 1·6 | ·1250 | 3·15 | 4·75 | ·1250 | 1·05 | ·1250 | 6·3 | 7·35 | ... | ... | ... | ... | ... | |
| | | | | | | | | | | | | (9) | | | | | | | | |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ·1250 | 1·3 | ·0930 | 9·0 | 10·3 | ... | ... | ... | ... | ... | |
| | | (8) | | | | | | | | | | (7) | | | | | (3) | | | |
| ·1860 | 1·8 | ·1250 | 9·6 | 11·4 | ... | ... | ... | ... | ... | ·1250 | 1·2 | ·1250 | 8·4 | 9·6 | ·2500 | 2·5 | ·2500 | 7·5 | 10·0 | |
| | | (7) | | | | | (9) | | | | | | | | | | (7) | | | |
| ·1860 | 1·6 | ·1250 | 7·7 | 9·3 | ·1860 | 1·6 | ·0930 | 7·2 | 8·8 | ·1250 | 1·1 | ·1250 | 6·6 | 7·7 | ·2500 | 2·2 | ·1860 | 11·2 | 13·4 | |
| | | | | | | | | | | | | | | | | | (4) | | | |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ·2500 | 2·3 | ·2500 | 9·2 | 11·5 | |
| | | | | | | | | | | | | (9) | | | | | (2) | | | |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ·1250 | 1·8 | ·1250 | 16·2 | 18·0 | ·2500 | 3·6 | ·2500 | 7·2 | 10·8 | Local irrigation. |
| | | (29) | | | | | | | | | | | | | | | (3) | | | |
| ·1250 | 1·3 | ·0625 | 18·8 | 20·1 | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ·2500 | 2·6 | ·2500 | 7·8 | 10·4 | |
| | | (19) | | | | | | | | | | (9) | | | | | | | | |
| ·1250 | 0·9 | ·0960 | 12·3 | 13·2 | ... | ... | ... | ... | ... | ·1250 | 0·9 | ·1250 | 8:1 | 9·0 | ... | ... | ... | ... | ... | All Kachis. |
| ... | ... | ... | ... | 14·0 | ... | ... | ... | ... | 10·0 | ... | ... | ... | ... | 11·5 | ... | ... | ... | ... | 11·5 | Mean. |
| | | | | | | | | | | | | | | | | | (7) | | | |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ·2500 | 1·2 | ·1860 | 6·3 | 7·5 | |
| | | (9) | | | | | (9) | | | | | (11) | | | | | | | | |
| ·1860 | 0·9 | ·1250 | 5·4 | 6·3 | ·1250 | 0·6 | ·0930 | 4·1 | 4·7 | ·1250 | 0·6 | ·1250 | 6·6 | 7·2 | ... | ... | ... | ... | ... | |
| | | | | | | | | | | | | (9) | | | | | (2) | | | |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ·1250 | 1·0 | ·1250 | 9·0 | 10·0 | ·2500 | 2·0 | ·2500 | 4·0 | 6·0 | |
| | | (29) | | | | | | | | | | | | | | | (3) | | | |
| ·1250 | 0·5 | ·0625 | 7·2 | 7·7 | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ·2500 | 1·0 | ·2500 | 3·0 | 4·0 | |
| | | | | | | | | | | | | | | | | | (1) | | | |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ·2500 | 6·0 | ·2500 | 6·0 | 12·0 | All hired labor. |
| | | (19) | | | | | | | | | | (19) | | | | | (1) | | | |
| ·1250 | 0·8 | ·0930 | 11·4 | 12·2 | ... | ... | ... | ... | ... | ·1250 | 0·8 | ·0930 | 11·4 | 12·2 | ·2500 | 1·6 | ·2500 | 1·6 | 3·2 | |
| ... | ... | ... | ... | 9·0 | ... | ... | ... | ... | 4·7 | ... | ... | ... | ... | 9·8 | ... | ... | ... | ... | 6·5 | |
| | | (27) | | | | | | | | | | (27) | | | | | | | | |
| ·1250 | 0·6 | ·0625 | 8·1 | 8·7 | ... | ... | ... | ... | ... | ·1250 | 0·6 | ·0625 | 8·1 | 8·7 | ... | ... | ... | ... | ... | |
| | | (19) | | | | | | | | | | (9) | | | | | | | | |
| ·1250 | 0·5 | ·0960 | 6·1 | 6·6 | ... | ... | ... | ... | ... | ·1250 | 0·5 | ·1250 | 4·5 | 5·0 | ... | ... | ... | ... | ... | |
| | | (19) | | | | | | | | | | (19) | | | | | (1) | | | |
| ·1250 | 0·5 | ·0930 | 6·6 | 7·1 | ... | ... | ... | ... | ... | ·1250 | 0·5 | ·0930 | 6·6 | 7·1 | ·2500 | 1·0 | ·2500 | 1·0 | 2·0 | |
| | | | | | | | | | | | | | | | | | (7) | | | |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ·2500 | 1·4 | ·1860 | 7·7 | 9·1 | |
| ... | ... | ... | ... | 7·5 | ... | ... | ... | ... | ... | ... | ... | ... | ... | 7·0 | ... | ... | ... | ... | 6·0 | |

*Explanation of Table* H.

The Crops noted are those usually irrigated. Abnormal examples are omitted from all mean results given, and the quantity of water lifted is calculated for a day of 9 working hours.

The rates for human labor are fixed with reference to whether home or hired labor is most usually employed.

The following may be noted regarding rates—

Cawnpore—high, as cattle are bad.

Hamirpur—low, as cattle are little worked except for ploughing and cultivators are Kachis.

Farukhabad—low, as cultivators are good.

Mainpuri—<br>Etah—<br>Saharanpur— } low, as water surface near ground.

Muttra—low, cultivators and cattle good.

Aligarh—<br>Bulandshahr—<br>Meerut— } low water-supply, cattle and cultivators good.

Bareilly—low, all Kachi cultivators.

Lucknow—high, supply bad. These figures should not be accepted without further enquiry.

The interest charges are those which will apply per acre when, the mota exists at an average depth, a masonry* well is used, and the full percentage of ordinary crops is irrigated. Interest charges are high in Muttra on account of great depth to water surface.

Shahjahanpur—<br>Moradabad—<br>Bareilly— } high because crops, such as tobacco, requiring a large number of waterings are usually irrigated.

* Except when noted otherwise.

# APPENDIX I.

*Note to* DIRECTOR, *Department of Agriculture and Commerce, N.-W. Provinces and Oudh.*

## EXPERIMENTS FOR DETERMINING THE TRUE ACTION OF THE *MOTA* IN WELLS.

IN para. 28 of the Report on Well Irrigation, reference is made to the manner in which the "mota" acts as a beam to support the well over a cavity in the sand below, the suppositions which are there advanced were at the time purely theoretical, it being manifestly impossible to see the action which takes place below the mota in any existing well.

2. Government having desired the submission of the Well Report by the 15th August 1882, I had no opportunities before that date of practically verifying the exactness of the theories advanced, but the great importance of the subject induced me to devote a portion of the leave which was subsequently granted to me to practical experiments in the matter.

3. I advisedly say *great importance*, for a careful study of the subject will show that until the action of the mota is thoroughly understood, the construction of successful wells is hopeless. I need hardly again refer to the Moradabad wells, but I may here mention, that I have had an opportunity within the last few days of inspecting a few of the eight State wells sunk at Ghazipur some 7 years ago, not one of which has reached the mota, and in consequence they have all sunk and cracked more or less, and from none is even a fair supply of water derived.

These wells cost Rs. 500 each, and if they had been taken down to the mota, which is practically found everywhere on the farm, would have given an ample supply of water and probably proved satisfactory investments.

4. Two main experiments were made—

A. With an imperfect mota,

B. With a perfect mota,

which I will endeavour to briefly describe.

A. This experiment was at first intended to represent the action of a perfect mota, but defects in the apparatus which showed themselves when it was being worked, necessitated its reconstruction in an improved form.

The results, however, were very interesting, and obviated the necessity of a separate experiment on a well resting entirely in sand without any mota.

5. The apparatus employed consisted of a stout box (*Fig.* 18, *Plate* II.), the back and sides being made of wood and the front of a sheet of plate glass; this box was watertight excepting at the man holes *a*, *a* which were provided with doors and clamps to close them when necessary.

A thick board M was firmly cemented to the back and front of the box a few inches above the bottom to represent the mota; it did not extend to the sides of the box; an open space a few inches wide being left at each end.

W, W′ the model well was made below of glass and above of tin; it was $2\frac{1}{2}$ inches diameter, and was fixed tightly into the top of the box touching as closely as possible the glass plate in front.

6. The lower glass tube W rested in a shallow groove cut in M, the joint being pointed with white lead, and a hole three-eighths of an inch diameter was cut through M in the centre of the well. All the joints for the sides of the box and the mota were carefully made with strips of flannel and white lead paint, and the joint of the mota M with the glass front was further strengthened by the addition of a strong wooden bar with India rubber buffers between it and the glass to resist pressure from within tending to separate the glass from the mota.

7. When this box was filled with sand and water the tube represented a well resting on the mota under the most ordinary conditions found in the Doáb, and it is evident that no water poured in at *a*, *a*, can enter the well except by the small hole three-eighths of an inch diameter in the mota.

8. For experiment A, the box was carefully filled with moderately fine, dry, sifted sand, obtained from the bed of the Kicha river, and water was slowly poured in at *a*, *a*, so as to maintain one inch in depth of water over the surface of the sand. For the purpose of emptying the well a glass syphon half inch diameter was provided.

9. It was curious to note how slowly the water soaked into the sand, the rate being about one foot per hour, this was when the sand was dry. After it had become thoroughly saturated, the rate was apparently much increased.

10. When the saturation of the dry sand was complete, the water began to pass into the well through the small hole in the mota, at first slowly and quite clear, but as the saturation increased more rapidly, mixed with sand, until a small quantity of sand had collected in the bottom of the well, this was removed by the syphon and the experiment continued.

11. Up to this point all had gone on most successfully, but suddenly the quantity of sand drawing into the well increased in a marked manner, and it became evident that the joints between the glass and the mota and the bottom of the well and mota were imperfect. This was due to the great pressure which the sand and water inside the box exerted on the glass front, moving it slightly forward and away from the mota, notwithstanding the buffer beam before mentioned.*

12. The aperture thus created was scarcely wide enough to admit of the passage of a sheet of writing paper, but the mixed sand and water passed freely down it and into the well through the $\frac{3}{8}$-inch hole in the mota. The joint of the glass tube W with the mota M also proved defective, although it had been made with considerable care, (*see Fig.* 19, *Plate* II.) and sand passed freely in here also.

13. After the experiment had been continued for some hours, great hollows and depressions appeared in the sand surrounding the well, and no water could be removed from it without drawing in a considerable quantity of sand, and it was evident that had the well been unsupported by the mota, it would have gradually sunk into the sand in a manner exactly similar to that in which the Moradabad wells, resting in pure sand, sunk when experimented upon.

14. A remarkable fact observed during this experiment was the manner in which the sand in the well ran up the syphon pipe when it was employed to empty the well. Even when the head on the syphon was only a few inches, sand was freely carried up it, and discharged at the lower end, and this observation is valuable with reference to the pipes employed in the Moradabad wells, and may hereafter be profitably utilized for sinking wells by means of steam machinery.

15. For experiment B an improved apparatus was constructed (*vide Fig.* 20, *Plate* II.), but on similar principles. W is the well in vertical section, the brass model of which

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* It may be noted that this buffer was so tightly screwed up, that during the night the glass cracked from apparently unequal contraction by cold.

is firmly screwed on to the glass front of the box and to the mota M. The position of the man holes *a*, *a*, was altered so as to permit of the sand being more firmly packed under the mota, and a pipe P was added for the supply of water with any desired head.

As in experiment A the water was allowed to flood* over the surface of the sand about one inch in depth, and a head of about 18 inches was maintained in the pipe P.

16. As in experiment A after the water had permeated all the sand in the box, a small quantity slowly filtered into the well through the small hole in the mota. This was steadily withdrawn by means of the syphon, and as the saturation of the sand increased, the quantity of water discharged into the well also became greater, and carried sand up with it. This action continued until a hollow exactly as shown on *Fig.* 5, *Plate* I. of the Report appeared under the mota, *vide Fig.* 21, *Plate* II.

17. Along the surface *s*, *s*, of the cone-shaped hollow thus formed, the sand could be seen bubbling up, but the size of the hollow, as far as could be noted, remained constant, unless the quantity of water removed from the well was increased.

18. The results of this experiment conclusively dispose of the *spring* theory of wells, and show that the practical use of the mota is to support the well over the hollow which in irrigation wells must be formed to supply a surface of sand, large enough to discharge a given quantity of water without disturbance.

19. In fine sand where the mota does not exist, the only certain means of constructing irrigation wells will probably be by constructing an artificial mota of concrete, for the free discharge of sand up the syphon would appear to prohibit the use of *short* pipes at all events, even when the well is prevented from sinking by a concrete bottom.

If, however, the construction of wells on an artificial mota is at any time seriously contemplated, it will be necessary first to undertake a complete series of experiments on a large scale to determine the actual size of hollow which will form in sand of various degrees of fineness, with certain fixed discharges, as before this is known, it will be impossible to accurately determine the necessary dimensions of the mota.

20. I would venture to suggest that a small sum might, however, be profitably expended on the construction of *one* experimental well with an artificial mota, in say the Bijnor District, where the community are anxious for agricultural improvements, and I will be most happy to supply the designs for such a well if called upon to do so.

CAWNPORE, J. C.
15*th November*, 1882.

* At first the box was tightly packed with sand to the top, but the saturation proceeded so slowly owing to the limited area of the bottom of tube P, that it was found necessary to remove some of the sand and allow the water to flood over the whole surface.

# APPENDIX II.

*Note to* DIRECTOR, *Department of Agriculture and Commerce, N.-W. Provinces and Oudh.*

IN para. 159 of the Rèport on Well Irrigation, reference was made to the great advantages which canal tracts, in which the sub-soil water surface has been unduly raised, offer for the construction of wells, and an opinion was previously expressed* that in the Secunder Rao Tahsil the cultivators had in *one year* of themselves provided the wells and this *without advances.* I have now been favored with the figures for the villages referred to, which were previously unattainable, and the results prove even more favorable than was anticipated.

2. It will be seen that well irrigation *has more than replaced the canal irrigation* which was cut off, and even if it be contended that 1289 fasli was a year more favorable for the spread of irrigation than 1287, and it certainly was a year in which the rabi could scarcely be matured without water, yet we find that the cultivated area in 1289 is only

| B. | B. | B. |
|---|---|---|
| 106 | 6 | 0 |

less than in 1287 fasli in the villages refered to.

3. These results are certainly most interesting, and should encourage Government to try like experiments in other tracts under similar conditions, particular attention being paid to the financial state of the cultivators, who will be found richest where canal water has been most freely given.

4. The canal water thus liberated can be well used up where more urgently needed, thus doubling the benefit of the proposed action.

The statement refers to the following villages :—

*Pargana Akerabad.*

| | | | |
|---|---|---|---|
| 1, Akerabad. | 4, Bhimpur Haripur. | 7, Bijulpur. | 10, Sinaoli Dinaoli. |
| 2, Sulpura. | 5, Kilanpur. | 8, Kanakpur. | 11, Kiratpur. |
| 3, Ludhu. | 6, Gudmi Misripur. | 9, Gopi with Miglas. | 12, Maudampur. |

The irrigation areas per unit appear correct when tested by the mean work for the Aligarh District.

* After an examination of the tract referred to in company with Mr. A. Lang, C.S., the Collector of Aligarh.

*Statement showing the progress made in replacing Canal by Well Irrigation, in the recently Canal debarred tracts of Tahsil Secunder Rao, Aligarh District.*

| Year, 12 villages. | Total Area, Bigahs. | Cultivated. | | Uncultivated. | | Detail of irrigated area. | | | Detail of Wells. | | | | Remarks. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Wet. | Dry. | Culturable. | Waste. | Wells. | Canals. | Other sources. | Masonry | Dry Brick. | Kucha. | Total. | |
| F. 1287,* | 24,343 11 0 | 6,038 9 0 | 5,189 5 0 | 3,035 16 0 | 10,080 1 0 | 3,371 16 0 | 2,560 6 0 | 106 7 0 | 105 | 18 | 79 | 202 | * One year before canal irrigation was debarred. |
| F. 1289,† | 24,343 11 0 | 6,814 16 0 | 4,306 12 0 | 3,166 13 0 | 10,855 10 0 | 6,187 3 0 | 165 19 0 | 461 14 0 | 109 | 57 | 114 | 280 | † First year after canal irrigation was debarred. |

The wells are all worked "Kili," and generally with two pairs of cattle to each lift.
Mean yearly area per well = 22 bigahs in 1289.
" " " " lift = probably 10 bigahs.
" " " pair of cattle = " 5 " or say 3 acres.

A careful study of the statistics for each village shows that several masonry and dry brick wells have failed, and that the cultivators have apparently tried various classes of wells, abandoning those kinds ultimately found unsuitable.

MEMO.

The time shown as the number of hours of work includes daily halt at noon, probably two hours.

The depths to water surface are doubtful.

The actual number of cattle and men employed are taken out from the daily register, and the cost charged at—

3 annas per pair of cattle.

1 anna per man after deducting one man, per day.

The interest and lift charges are approximate, and too much dependence should not be placed on them.

The following may be noted—

(1). Work rarely continues for the full month. Usually in good well from 15 to 20 days each month.

(2). Cost of lifting varies from Rs. 3 to Rs. 10 per acre.

(3). Period of watering varies from 1st November to the end of March.

(4). The interval between waterings is about one month.

## APPENDIX

*Showing the Total Work of 34 Wells which were daily observed*

| District. | Village. | Depth of water. | Class. | No. of Lifts. | Labor. | | Cultivators. | Number of day's work done | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Cattle. | Men. | | October. | November. | December. | January. | February. |
| Saharanpur, .. Deoband, .. | Etahshaja, .. | 11 | Kacha, | 1 | 8 | 5 | 3 Tagas, | .. | 12 hours 25 to 29 | .. | .. | .. |
| Muzaffarnagar, | Bugra, .. | 30 | Masonry, | 1 | 8 | 4 | 3 Mahomedan, | .. | 10 hours 20-30 | 11 hours 25 days | 10 hours 1-5 | .. |
| „ .. | Luchra, .. | 30 | „ | 1 | 4 | 4 | 2 Thakurs, | .. | .. | 10 hours 1-2 | .. | .. |
| „ .. | Purbalyan, .. | 14 | „ | 1 | 4 | 4 | 3 Jats, | .. | 10 hours 6-15 | 10 hours 8 days | .. | .. |
| „ .. | Kolesrah, .. | 16 | „ | 2 | 16 | 10 | 3 Tagas, | 10 hours 8-28 | .. | 11 hours 11-31 | 11 hours 1-8 | .. |
| „ .. | Shapur, .. | 40 | „ | 2 | 4 | 4 | 12 „ | .. | 10 hours 30 days | 10 hours 31 days | .. | .. |
| Meerut, .. | Radua, .. | 11 | „ | 1 | 4 | 4 | 9 Mahomedan | .. | 9 hours 15 days | 8 hours 16 days | 10 hours 25-30 | 9 hours 23-27 |
| „ .. | Dhukali, to W. S. 8′ | 13 | „ | 1 | 8 | 6 | 12 Thakurs | .. | .. | 11 hours 13-28 | 11 hours 1-20 | .. |
| „ .. | Katra, to W. S. 18′ | 10 | „ | 1 | 4 | 4 | 2 Jats, | .. | .. | 9 hours 20 days | .. | .. |
| Bulandshahr, .. | Ghurwali, to W. S. 30′, .. .. | | „ | 5 | 20 | 11 | 2 Thakurs, | .. | .. | 12-31 | 11 hours 1-9 17-31 | 8 hours 6 days |
| „ .. | Chand, to W. S. 25′, | 20 | „ | 2 | 8 | 4 | 8 Mahomedan | 10 hours 25-28 | 10 hours 7-15 | 10 hours 14-31 | 10 hours 1-12 23-29 | 10 hours 1-2 7-10 |
| Mainpuri, .. | Shakarwar, .. | 6·2 | Kacha, | 1 | 4 | 3 | 1 Chamar, | .. | .. | 8 hours 17 days | 8 hours 10 days | .. |
| „ .. | Madunpur, to W. S. 57′, .. .. | | „ | 1 | 2 | 3 | 1 Kachi, | .. | .. | 8 hours 1-26 | 9 hours 16 days | 10 hours 12 days |
| „ .. | Guroj Puridugmai, to W. S. 17′, .. .. | | Masonry, | 3 | 6 | 7 | .. | .. | 4 hours 29-30 | 8 hours 1-12 | 9 hours 23-30 | 9 hours 19-29 |
| „ .. | Bewai, to W. S. 22′, .. | | „ | 2 | 6 | 6 | 3 Brahmin | .. | .. | 12 hours 1-14 | 12 hours 12 days | 12 hours 8 days |
| „ .. | Arum Sarae, to W. S. 8′, .. .. | | Kacha, | 1 | 2 | 3 | 3 Kaeths, 2 Chamars, | .. | 9 hours 1-3 | 10 hours 18-31 | 10 hours 25 days | 11 hours 19 days |
| „ .. | Tardpur, to W. S. 10′, .. .. | | Masonry, | 3 | 9 | 6 | 1 Ahir, 2 Lodhas | .. | 11 hours 27 days | 12 hours 26 days | 12 hours 23 days | 12 hours 19 days |
| „ .. | Suraha, to W. S. 17′, .. .. | | Kacha, | 1 | 8 | 5 | 1 Ahir, | .. | .. | 10 hours 1-10 | 9 hours 1-7 25-31 | 8 hours 27-28 |

III.

*during the Rabi Irrigation* 1881-82.

| EACH MONTH. | | | Total No. of working days. | TOTAL LABOR EMPLOYED. | | Area irrigated, acres. | Cost, Rupees. | Cost per acre. | DETAIL OF AREA. | | | | ANNUAL CHARGES. | | | Total cost per acre. | Remarks. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| March. | April. | May. | | Cattle. | Men. | | | | Crop. | Area. | No. of waterings. | Relative value in annas. | Interest on construction and repairs. | Cost of Lifts. | Total. | | |
| .. | .. | .. | 5 | 40 | 25 | 0·9 | 5·0 | 5·5 | Rabi, .. | 0·9 | 1 | -/12/- | 1/- | 8/- | 9/- | 15·5 | Lagor. W. S. reduces 4' when worked. |
| .. | .. | .. | 40 | 320 | 160 | 18·0 | 38·0 | 2·1 | Wheat, | 16·5 | 1·5 | -/12/- | 10/- | 10/- | 20/- | 3·2 | Kili. |
| | | | | | | | | | Barley, | 1·5 | 2·0 | -/12/- | .. | .. | .. | .. | |
| .. | .. | .. | 2 | 8 | 8 | 1·5 | 1·2 | 0·8 | Wheat, .. | 1·5 | 1 | -/10/- | 10/- | 10/- | 20/- | 14·0 | Kili. 18m. kucha. |
| .. | .. | .. | 18 | 72 | 72 | 5·5 | 10·1 | 1·9 | „ | 5·6 | 2 | -/12/- | 7/- | 10/- | 17/- | 5·0 | Kili. Water supply short. 50 m. kucha. |
| .. | .. | .. | 50 | 658 | 329 | 27·5 | 79·0 | 2·9 | Rabi, .. | 27·5 | 2 | -/12/- | 10/- | 18/- | 28/- | 4·0 | Kili. Probably wheat. |
| .. | .. | .. | 61 | 244 | 244 | 20·0 | 34·3 | 2·7 | Wheat, .. | 20·0 | 2 | -/12/- | 10/- | 18/- | 28/- | 4·1 | Kili. |
| 10 hours 1-7 | .. | .. | 50 | 220 | 220 | 12·6 | 31·2 | 2·5 | Peas, | 5·3 | 2 | -/13/- | 8/- | 10/- | 18/- | 4·0 | „ |
| | | | | | | | | | Barley, | 4·0 | 1 | -/14/- | | | | | |
| | | | | | | | | | Wheat, | 3·3 | 1 | -/14/- | | | | | |
| .. | .. | .. | 36 | 256 | 166 | 12·5 | 32·1 | 2·6 | Wheat, | 12·5 | 1 | -/14/- | 6/- | 10/- | 16/- | 4·0 | „ |
| .. | .. | .. | 20 | 80 | 80 | 7·1 | 11·3 | 1·6 | „ | 7·1 | 1 | -/14/- | 6/- | 10/- | 16/- | 3·8 | „ |
| 9 hours 1-11 | .. | .. | 60 | 1000 | 555 | 29·5 | 12·5 | 4·3 | „ | 29·5 | 3 | 1/- | 30/- | 40/- | 70/- | 6·6 | „ |
| .. | .. | .. | 56 | 364 | 188 | 14·0 | 42·4 | 3·0 | Wheat, | 5·0 | 2 | -/14/- | 15/- | 20/- | 35/- | 5·5 | „ |
| | | | | | | | | | Barley, | 5·8 | 2 | -/14/- | | | | | |
| | | | | | | | | | Peas, | 3·3 | 2 | -/14/- | | | | | |
| 10 hours 7 days | .. | .. | 34 | 98 | 102 | 3·5 | 13·5 | 3·8 | Wheat, | 2·3 | 3 | 1/- | 1/- | 6/- | 7/- | 5·8 | Lagor. |
| | | | | | | | | | Gujai, | 1·2 | 2 | 1/- | | | | | |
| .. | .. | .. | 54 | 108 | 162 | 2·0 | 17·0 | 8·5 | Gujai, | 2·0 | 3 | -/10/- | 1/- | 6/- | 7/- | 12·0 | „ |
| 9 hours 8-13 | .. | .. | 37 | 186 | 199 | 5·0 | 27·5 | 5·5 | Wheat, .. | 5·0 | 3 | -/12/- | 12/- | 15/- | 27/- | 10·9 | „ 17 m. Grain. 15 „ Bhusa. |
| .. | .. | .. | 34 | 124 | 150 | 2·3 | 19·0 | 8·2 | Wheat, | 1·3 | 2 | 1/- | 10/- | 10/- | 20/- | 16·5 | „ 14 „ Grain. 5 „ Bhusa. |
| | | | | | | | | | Barley, | 1·0 | 2 | 1/- | | | | | |
| .. | .. | .. | 61 | 122 | 183 | 4·0 | 19·0 | 4·8 | Wheat, | 2·7 | 2 | 1/- | 1/- | 6/- | 7/- | 6·5 | Lagor. |
| | | | | | | | | | „ | 1·3 | 1 | -/13/- | | | | | |
| 12 hours 9 days | .. | .. | 104 | 342 | 504 | 29 | 57 | 2·0 | Wheat, | 12·8 | 3 | x | 10/- | 15/- | 25/- | 2·8 | „ |
| | | | | | | | | | Barley, | 16·2 | 3 | x | | | | | |
| 8 hours 1-4 | .. | .. | 30 | 132 | 110 | .. | 17·4 | .. | Wheat, .. | .. | 3 | .. | 2/- | 8/- | 10/- | .. | „ |

APPENDIX

*Showing the Total Work of 34 Wells which were daily observed*

| District. | Village. | Depth of water. | Class. | No. of Lifts. | Labor. Cattle. | Labor. Men. | Cultivators. | Number of day's work done: October. | November. | December. | January. | February. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | 10 hours 14-21 | 8 hours | 9 hours | 10 hours |
| Etah, .. | Sakadeh, .. | 23 | Dry brick, | 2 | 8 | 5 | 3 Mahomedan, | .. | 24-30 | 31 days | 25 days | 10 days |
| „ .. | Mohunpur, .. | 17 | „ | 1 | 2 | 3 | 2 Kachi; 1 Lodha, 2 Thakur, | .. | 9 hours 1-3 | 8 hours 20-31 | 10 hours 9 days | 10 hours 11 days |
| „ .. | Bagidpur, .. | 5 | Kacha, | 1 | 2 | 3 | 1 Thakur, | .. | 10 hours 10-29 | 11 hours 1-9 | 11 hours 8-17 | 11 hours 26-28 |
| Muttra, .. | Kosi Khurd, to W. S. 18·7′, .. | 8 | Masonry, | 4 | 16 | 16 | 2 Thakur, | .. | .. | 9 hours 4-31 | 8 hours 1-7 | .. |
| „ .. | Narkaki Gurhi, to W. S. 18′, .. | .. | „ | 4 | 8 | 10 | 1 Jat, | .. | 9 hours 30 days | 9 hours 31 days | 8 hours 29 days | 8 hours 28 days |
| „ .. | Jerali, to W.S. 37·5′, .. | .. | „ | 1 | 8 | 4 | 1 Gujar, | .. | 5 hours 17-31 | 7 hours 31 days | 6 hours 27 days | 6 hours 20 days |
| Aligarh, .. Secunder Rao, .. | Khera, to W.S. 22′, .. | .. | „ | 1 | 4 | 3 | 4 Brahmin, | .. | 9 hours 9-29 | 11 hours 30 days | 11 hours 18 days | 8 hours 15 days |
| Etawah, .. | Rohan, to W. S. 21′, .. | .. | „ | 1 | 2 | 3 | 2 Chamar, | .. | 10 hours 27-29 | 10 hours 4 days | 10 hours 3 days | 10 hours 1 day |
| „ .. | Kali Khurd, to W.S. 27′, .. | .. | „ | 2 | 4 | 4 | 2 Ahir, | .. | 10 hours 5-30 | 10 hours 5-31 | 10 hours 1-9 10-31 | 9 hours 1-15 |
| „ .. | Bybaha, .. | 6 | „ | 2 | 4 | 4 | 1 Brahmin, | .. | .. | 10 hours 10-20 | 10 hours 11-20 | 10 hours 8-15 |
| „ .. | Beha, to W. S. 76′, | 7 | Kacha, | 2 | 4 | 4 | 2 „ | .. | .. | 12 hours 11, 20, 31 | 12 hours 19, 21, 31 | 12 hours 8, 15, 22 |
| „ .. | Imdrauli, to W. S. 48′, .. | 15 | „ | 1 | 2 | 3 | 2 Brahmin, | .. | .. | 10 hours 5th | 10 hours 1st to 8th | 10 hours 6th-26th |
| „ .. | Chagaon, to W. S. 50′, .. | .. | „ | 1 | 2 | 3 | 1 Lodha, | .. | .. | 8 hours 22 days | 8 hours 28 days | 8 hours 28 days |
| Cawnpore, .. | Akberpur, to W. S. 22′, .. | 4 | Masonry, | 2 | 4 | 4 | 1 Ahir, 1 Lodha, 1 Weaver, | .. | 8 hours 8-14 | 8 hours 20-25 | .. | 8 hours 8-11 |
| „ .. | Jalapur, to W.S. 13′, .. | .. | „ | 2 | 4 | 4 | 1 Thakur, 1 Fakir, | .. | 12 hours 29th | 12 hours 11 days | 12 hours 9 days | 6 hours 7 days |
| Gurgaon, .. | Maya, to W. S. 13′, .. | .. | „ | 1 | 4 | 4 | 2 Brahmin, | .. | .. | 12 hours 15 days | 12 hours 17 days | 12 hours 15 days |

III.

*during the Rabi Irrigation* 1881-82—(Continued).

| EACH MONTH. | | | Total No. of working days. | TOTAL LABOR EMPLOYED. | | Area irrigated, acres | Cost, Rupees. | Cost per acre. | DETAIL OF AREA. | | | | ANNUAL CHARGES. | | | Total cost per acre. | Remarks. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| March. | April. | May. | | Cattle. | Men. | | | | Crop. | Area. | No. of waterings. | Relative value in annas. | Interest on construction and repairs. | Cost of Lifts. | Total. | | |
| 10 hours 8 days | .. | .. | 90 | 720 | 450 | .. | 90 | .. | Wheat, Gujai, Barley, | .. | 3 to 4 | 1/- | .. | .. | .. | .. | Lagor. |
| 9 hours 4 days | .. | .. | 40 | 80 | 120 | 1·25 | 12·5 | 10·0 | Wheat,.. | 1·25 | 2 | .. | 3/- | 7/- | 10/- | 18·0 | „ |
| 11 hours 1-4 | .. | .. | 46 | 92 | 138 | 4·3 | 14·4 | 3·4 | Wheat, Gujai, | 3·3<br>1·0 | 2<br>1 | -/12/-<br>-/11/- | 1/- | 6/- | 7/- | 5·0 | „ |
| .. | .. | .. | 35 | 456 | 456 | 10·0 | 69 | 69 | Rabi, .. | 10 | 1 | 1/- | 20/- | 25/- | 45/- | 11·4 | 2 from Canal, 1 from well. Khara water, Kili. |
| 8 hours 18 days | .. | .. | 136 | 1088 | 1360 | 17·4 | 178·5 | 10·0 | „ | 17·4 | 4 | .. | 20/- | 25/- | 45/- | 16·2 | Kili. |
| .. | .. | .. | 93 | 744 | 372 | 8·0 | 87 | 11·0 | „ | 8·0 | 3 | -/7/- | 10/- | 10/- | 20/- | 13·5 | Khara Kili. |
| 9 hours 1-9 | .. | .. | 93 | 372 | 279 | 8·6 | 40·3 | 4·7 | Wheat, Gujai, Barley, | 2·2<br>5·0<br>1·4 | 4<br>3<br>3 | 1/-<br>1/-<br>1/- | 8/- | 10/- | 18/- | 7·8 | Kili sweet water. |
| .. | .. | .. | 11 | 22 | 33 | 0·9 | 3·5 | 4·0 | Barley, .. | 0·9 | 1 | 1/- | 8/- | 8/- | 16/- | 22·0 | Lagor. |
| .. | .. | .. | 100 | 400 | 400 | 9·9 | 56·3 | 5·7 | Wheat, Barley, | 4·0<br>5·5 | 3<br>3 | 1/-<br>1/- | 10/- | 16/- | 26/- | 8·3 | „ |
| .. | .. | .. | 29 | 116 | 116 | 3·8 | 14·5 | 3·8 | Barley,.. | 3·8 | 3 | 1/- | 12/- | 16/- | 28/- | 12·2 | Lagor, very good example. |
| 10 hours 8-21 | .. | .. | 11 | 44 | 44 | 0·5 | 6·2 | 12·4 | Wheat,.. | .. | 11 | 1/- | 1/- | 10/- | 11/- | 34·4 | |
| 10 hours 2-19-28 | .. | .. | 8 | 16 | 24 | 0·6 | 2·3 | 4·0 | Barley,.. | 0·6 | 3 | 1/- | 1/- | 5/- | 6/- | 14·0 | |
| 8 hours 27 days | .. | .. | 105 | 210 | 315 | 4·8 | 33·0 | 6·8 | Wheat,.. | 4·8 | 5 | 1/- | 1/- | 8/- | 9/- | 8·7 | Lagor, good example. |
| .. | .. | .. | 18 | 62 | 62 | 1·5 | 8·5 | 5·6 | „ | 1·5 | 3 | -/14/- | 5/- | 8/- | 12/- | 14·3 | „ „ |
| .. | .. | .. | 28 | 90 | 100 | 2·5 | 12·1 | 5·0 | Rabi, .. | 3·8 | 2·5 | 1/- | 5/- | 12/- | 17/- | 11·8 | „ „ |
| 12 hours 15 days | .. | .. | 62 | 248 | 248 | 6·0 | 35 | 5·8 | Wheat, Barley, Gram, | 2·0<br>3·7<br>0·3 | 5<br>4<br>1 | -/12/-<br>-/15/-<br>-/8/- | 4/- | 6/- | 10/- | 7·8 | „ „ |

## APPENDIX IV.

*Command of Lagor Wells in Rae Bareli, Oudh.*

| Village. | Perganna. | Wells. No. of wells. | Wells. No. of purs. | Area in Acres. Area irrigated rabi 1881. | Area in Acres. Area irrigated after rabi 1881. | Area in Acres. Balance area which could be irrigated if necessary. | Depth to water surface. | Area per Pur. Rabi. | Area per Pur. Kharif. | Area per Pur. Maximum area. | Remarks. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Taluka Kuri Sadauli, 10 villages, .. | Estates under direct management. | 202 | 295 | 1,033 | 190 | 270 | .. | 3·5 | 0·6 | 5·1 | The maximum area is that which can be irrigated from wells, this was pointed out by assamis field by field. The actual area irrigated in the year is the total of Rabi and Kharif. Sauwan cultivation in this District increases the area. |
| Taluka Amanian, 10 villages, .. | | 86 | 221 | 534 | 22 | 133 | .. | 2·4 | 0·1 | 2·9 | |
| Taluka Binohia, 7 villages, .. | | 75 | 188 | 505 | 1·0 | 140 | .. | 2·7 | .. | 3·5 | |
| Taluka Bahua, 5 villages, .. | | 55 | 138 | 332 | .. | 190 | .. | 2·4 | .. | 3·7 | |
| Taluka Bhiragoland, 8 villages, .. | | 48 | 189 | 421 | 25 | 91 | .. | 2·2 | 0·2 | 2·9 | |
| Taluka Bela Bila, 5 villages, .. | | 31 | 58 | 200 | 72 | 84 | .. | 3·5 | 1·2 | 6·1 | |
| Taluka Korihai Salam, 13 villages, .. | | 89 | 212 | 506 | 25 | 380 | .. | 2·4 | 0·1 | 4·3 | |
| Taluka Pandari Ganeshpur, 27 villages, | | 161 | 534 | 1,145 | 45 | 240 | .. | 2·1 | 0·1 | 2·7 | |
| Taluka Khajuri, 1 village, .. | | 9 | 29 | 56 | .. | 31 | .. | 2·0 | .. | 3·0 | |
| Taluka Shunkurpur, 7 villages, .. | | 40 | 158 | 411 | .. | 19 | .. | 2·6 | .. | 2·7 | |
| Taluka Azizabad, 7 villages, .. | | 18 | 57 | 312 | 11 | 20 | .. | 5·4 | .. | 6·0 | |
| Mean, 100 villages,.. | | 814 | 2079 | .. | .. | .. | .. | 2·84 | 0·2 | 3·9 | Mean. |
| Kasrawan, .. | Bareli and Bachrawan. | 42 | 57 | 156 | 45 | 37 | .. | 2·7 | 0·8 | 4·0 | 15 wells have fallen in. |
| Malhipur, .. | | 7 | 12 | 51 | 4·0 | 27 | .. | 4·2 | 0·3 | 7·0 | |
| Enchauli, .. | | 16 | 21 | 80 | 1·0 | 18 | .. | 3·8 | 0·5 | 6·2 | |
| Luchmanpur, .. | | 2 | 3 | 12·5 | .. | 10 | .. | 4·1 | .. | 7·5 | |
| Sarwar, .. | | 11 | 13 | 79 | 4·5 | 32 | .. | 6·0 | 0·4 | 9·0 | Remarks as for Court Estates Villages. Inspected by the Deputy Commissioner's Amla, Mahomed Ashraf, from 13th January to 10th February, 1882. |
| Malpur, .. | | 24 | 49 | 184 | 28 | 132 | .. | 3·7 | 0·6 | 7·0 | |
| Parer Kulan, .. | | 8 | 10 | 27 | 11 | 47 | .. | 2·7 | 1·1 | 8·5 | |
| „ Khurd, .. | | 9 | 15 | 62 | 4 | 30 | .. | 4·1 | 0·3 | 6·5 | |
| Deondhi, .. | | 9 | 16 | 75 | 10 | 72 | .. | 4·7 | 0·6 | 9·9 | |
| Bachrawan Khas, .. | | 42 | 55 | 280 | 8 | 108 | 27 | 5·1 | 0·2 | 7·2 | |
| Asahan Jagatpur, .. | | 28 | 44 | 181 | 6 | 32 | 27 | 4·4 | 0·2 | 5·0 | |
| Amanwan, .. | | 17 | 23 | 96 | .. | 90 | 28 | 4·2 | .. | 8·0 | |
| Charwa, .. | | 24 | 31 | 130 | .. | 57 | 28 | 4·2 | .. | 6·0 | |
| Pithan, .. | | 11 | 13 | 44 | 0·5 | 38 | 24 | 3·4 | .. | 6·4 | |
| Datauli, .. | | 16 | 29 | 108 | 6·0 | 78 | .. | 3·4 | 0·2 | 6·6 | |
| Seri, .. | | 21 | 25 | 60 | 3·0 | 60 | .. | 2·4 | 0·1 | 4·8 | |
| Carried over, .. | | 287 | 416 | 1625·5 | 131·0 | 878 | 134 | 63·1 | 5·3 | 109·6 | |

*Command of Lagor Wells in Rae Bareli, Oudh*—(Continued).

| Village. | Perganna. | Wells. No. of wells. | Wells. No. of purs. | Area in Acres. Area irrigated rabi 1881. | Area in Acres. Area irrigated after rabi 1881. | Area in Acres. Balance area which could be irrigated if necessary. | Depth to water surface. | Area per Pur. Rabi. | Area per Pur. Kharif. | Area per Pur. Maximum area. | Remarks. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Brought forward,.. | | 287 | 416 | 1625·5 | 131 | 878 | 134 | 63·1 | 5·3 | 109·6 | |
| Maghgawar Rao, .. | | 2 | 7 | 20 | .. | 19 | 34 | 3·0 | .. | 5·6 | |
| Dhondhari, .. | | 4 | 12 | 25 | 1·0 | 20 | 37 | 2·1 | 0·1 | 3·8 | |
| Mean, 18 villages,.. | | 293 | 342 | .. | .. | .. | 30 | 3·8 | 0·3 | 6·6 | Mean. |
| Rai Bareli, 117 villages, | | 231 | 606 | 1,655 | 173 | 1,383 | 30 | 2·7 | 0·3 | 5·3 | Same remarks. |
| Estate Ing Mohan Singh, 25 villages, | | 111 | 245 | 681 | 28 | 380 | 24 | 2·8 | 0·1 | 4·6 | Mean. |
| *Pergannas.* | | | | | | | | | | | |
| Inhanna, 15 villages,.. | Tahsil Digbijaiganj. | 17 | 39 | 106 | 26 | 72 | 28 | 2·7 | 0·6 | 5·2 | Same remarks. |
| Bachhrawar,18 villages, | | 35 | 46 | 151 | 21 | 218 | 21 | 3·3 | 0·4 | 8·4 | |
| Simrauta, 15 villages,.. | | 22 | 61 | 133 | 6·0 | 114 | 27 | 2·2 | 0·1 | 4·1 | |
| Kamranwan, 11 villages, | | 16 | 28 | 100 | 25 | 96 | 24 | 3·6 | 1·0 | 8·0 | |
| Mohanganj, 7 villages, | | 14 | 39 | 96 | 3·0 | 84 | 25 | 2·7 | 0·1 | 4·7 | |
| Hardui, 13 villages, .. | | 17 | 23 | 126 | 17 | 140 | 23 | 5·4 | 0·7 | 8·5 | |
| Mean, 79 villages,.. | | 121 | 236 | .. | .. | .. | 24 | 3·3 | 0·5 | 6·5 | Mean. |
| Hisampur, .. | Rakejais—Salon. | 3 | 6 | 16·0 | .. | .. | 13 | 2·6 | .. | 2·6 | |
| Mustafibad, .. | | 5 | 22 | 60·5 | .. | .. | 13 | 2·7 | .. | 2·7 | |
| Newada, .. | | 1 | 8 | 24 | .. | 8 | 27 | 3·0 | .. | 4·0 | |
| Itaura Bazurg, .. | | 1 | 4 | 28 | .. | 10 | 27 | 7·0 | .. | 9·5 | |
| Gandapi, .. | | 1 | 2 | 7·5 | .. | 9 | 36 | 3·2 | .. | 8·2 | |
| Kandi, .. | | 1 | x | .. | .. | 10 | 30 | .. | .. | .. | |
| Karimau, .. | | 1 | 6 | 8·0 | .. | 23 | 31 | 1·3 | .. | 5·1 | |
| Sankarsa, .. | | 3 | 8 | 13·2 | .. | 15 | 19 | 1·65 | .. | 3·5 | |
| Umri, .. | | 1 | 2 | 5·0 | .. | 2·1 | 15 | 2·5 | .. | 3·6 | |
| Semri Jhakrasi, .. | | 1 | 6 | 12·0 | .. | 7·2 | 21 | 2·0 | .. | 3·2 | |
| Achari Buzurg, .. | | 1 | 1 | 2·2 | .. | 3·5 | 21 | 2·2 | .. | 5·7 | |
| Bhagamaupur Barhaia, | | 1 | 4 | 21·3 | .. | .. | 30 | 5·3 | .. | 5·3 | |
| Dharupur, .. | | 3 | x | 1·1 | .. | 12·0 | 4·5 | .. | .. | .. | |
| Carried over, .. | | 23 | 69 | 198·8 | .. | 99·8 | 287·5 | 33·45 | .. | 33·4 | |

*Command of Lagor Wells in Rae Bareli, Oudh*—(Continued).

| Village. | Perganna. | Wells. No. of wells. | Wells. No. of purs. | Area in Acres. Area irrigated rabi 1881. | Area in Acres. Area irrigated after rabi 1881. | Area in Acres. Balance area which could be irrigated of necessary. | Depth to water surface. | Area per Pur. Rabi. | Area per Pur. Kharif. | Area per Pur. Maximum area. | Remarks. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Brought forward,.. | | 23 | 69 | 198·8 | .. | 99·8 | 287·5 | 33·45 | .. | 33·4 | |
| Dharsamau, .. | | 1 | 8 | 18·0 | .. | .. | 30 | 2·25 | .. | 2·25 | Omitted doubtful. |
| Suchi, .. | | 4 | 1 | 0·3 | .. | x | 24 | .. | .. | .. | |
| Khampur, .. | | 3 | 10 | 15·8 | .. | 10·5 | 19 | 15·8 | .. | 2·63 | |
| Raghanpur, .. | | 1 | 2 | 8·6 | .. | 2·1 | 15 | 4·3 | .. | 5·35 | |
| Nasirabad, .. | | 3 | 8 | 20·0 | .. | 8·2 | 12 | 2·5 | .. | 3·5 | |
| Ashadpur, .. | | 1 | 3 | 8·5 | .. | 3·2 | 31 | 2·8 | .. | 3·9 | |
| Shekhana, .. | | 1 | 3 | .. | .. | .. | 31 | .. | .. | .. | |
| Chanderana, .. | | 1 | 3 | .. | .. | .. | 31 | .. | .. | .. | |
| Khalispur, .. | Salon. | 1 | 4 | 7·3 | .. | 6·0 | 36 | 1·8 | .. | 3·3 | |
| Dayalpur, .. | | 1 | 6 | 6·4 | .. | 3·0 | 31 | 1·0 | .. | 1·6 | |
| Raipur Lodi, .. | | 1 | 6 | 5·5 | .. | 4·0 | 30 | 1·0 | .. | 1·6 | |
| Fatehpur, .. | | 1 | 8 | 12·0 | 6·2 | 4·0 | 35 | 1·5 | 0·8 | 2·8 | |
| Ashrafpur, .. | | 1 | 2 | 5·6 | .. | 3·4 | 27 | 2·8 | .. | 4·5 | |
| Bermawan, .. | | 3 | 18 | 27·1 | .. | 8·6 | 30 | 1·3 | .. | 2·0 | |
| Udari, .. | | 2 | 24 | 11·8 | 15·4 | 36·4 | 31 | 0·5 | 0·6 | 2·6 | |
| Gopalpur, .. | | 2 | 10 | 27·2 | .. | 5·1 | 42 | 2·7 | .. | 3·23 | |
| Parab Naeo, .. | | 1 | 8 | 9·1 | .. | 7·2 | 35 | 1·1 | .. | 2·0 | |
| Nigohi, .. | | 3 | 14 | 21·3 | .. | 9·4 | 43 | 1·5 | .. | 2·2 | |
| Mean, .. | | 54 | 208 | .. | .. | .. | 30 | 2·4 | 0·05 | 3·7 | |
| *Abstract.* | | | | | | | | | | | |
| Court Estate, 100 villages, .. | .. | 814 | 2079 | wells | mostly | 2 lift. | x | 2·84 | 0·2 | 3·9 | The Areas are shown by "Purs" or lifts, not by units, as the number of cattle employed on each lift are not known. The results by units might be less, but could not be greater than shown. |
| Bachrawan and Bareli, 18 villages, .. | .. | 293 | 342 | „ | „ | 1 „ | 30 | 3·8 | 0·3 | 6·6 | |
| *Estate of Ing.* Mohan Singh, 25 villages, .. | .. | 111 | 245 | „ | „ | 2 „ | 24 | 2·8 | 0·1 | 4·6 | |
| Rai Bareli Tahsil, 117 villages, .. | .. | 231 | 606 | „ | „ | 3 „ | 30 | 2·7 | 0·3 | 5·3 | |
| Tahsil Dighijaiganj, 79 villages, .. | .. | 120 | 236 | „ | „ | 2 „ | 24 | 3·3 | 0·5 | 6·5 | |
| Tahsil Salon, 31 villages, .. | .. | 54 | 208 | „ | „ | 4 „ | 30 | 2·4 | 0·05 | 3·7 | |
| General Mean, 370 villages, .. | | 1623 | wells | .. | .. | 2 lift. | 28 | 2·97 * | 0·24 * | 5·1 † | |

* Actual measurement. † Assami's estimate.

## APPENDIX V.

### Awa Court of Wards Estate.

*Statement showing actual Irrigation and estimated Command of Wells.*

| Villages. | Class of Well. | No. of Lifts | Depth to water surface. | Rabi area, Acres. | | Estimated command per Well. | Remarks. |
|---|---|---|---|---|---|---|---|
| | | | | Per Well. | Per Lift. | | |
| *Lagor Wells.* | | | | | | | |
| Bir Nagor, ... | Not known | 2 | 10 | 5 | 2·5 | 8·0 | It is not clear how the estimated command of these wells was arrived at. The areas per lift appear very small, the wells cannot be fully worked. |
| ,, ... | ,, | 2 | 10 | 4 | 2·0 | 5·0 | |
| ,, ... | ,, | 2 | 10 | 4 | 2·0 | 6·0 | |
| Barai, ... | ,, | 2 | 15 | 4 | 2·0 | 8·0 | |
| ,, ... | ,, | 2 | 15 | 5 | 2·5 | 6·0 | |
| Bara, ... | ,, | 2 | 23 | 4 | 2·0 | 10·0 | |
| Mean, ... | ,, | 2 | 14 | 4·5 | 2·25 | 7·17 | |
| *Kili Wells.* | | | | | | | |
| Bir Nagor, ... | ,, | 4 | 12 | 6·0 | 1·5 | 7·5 | |
| ,, ... | ,, | 4 | 10 | 6·4 | 1·6 | 6·25 | |
| ,, ... | ,, | 2 | 10 | 7·0 | 3·5 | 10·0 | |
| Mohanpur, ... | ,, | 6 | 12 | 10·0 | 1·66 | 5·84 | |
| Maudpura, ... | ,, | 6 | 20 | 6·0 | 1·0 | 2·83 | |
| ,, ... | ,, | 6 | 11 | 10·0 | 1·66 | 4·17 | |
| Kerya Saj, ... | ,, | 6 | 14 | 6·4 | 1·1 | 3·33 | |
| Misi Kulan, ... | ,, | 6 | 16 | 7·0 | 1·17 | 2·5 | |
| ,, ... | ,, | 6 | 17 | 7·0 | 1·17 | 4·33 | |
| Shanounau, ... | ,, | 4 | 13 | 8·0 | 2·0 | 6·25 | |
| Jawaoli, ... | ,, | 2 | 12 | 8·0 | 4·0 | 10·0 | |
| Nagla Kishen Singh,... | ,, | 2 | 24 | 6·0 | 3·0 | 10·0 | |
| Mohanpur, ... | ,, | 2 | 12 | 10·0 | 5·0 | 14·0 | |
| Awa Maudpur, ... | ,, | 2 | 15 | 6·0 | 3·0 | 8·5 | |
| Mean, ... | ,, | 4 | 14 | 7·4 | 2·24 | 6·8 | |

## APPENDIX VI.

*Examples of Reduction of Culturable Area due to Canals.*

| Locality. | | | | Total area, Acres. | Uncultivated. | | Cultivated. | | Double cropped Area. | Kharif. | | | | Rabi. | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| District. | Perganna. | Village. | Year. | | Waste. | Culturable. | Wet. | Dry. | | Wells. | Canals. | Other Sources. | Dry. | Wells. | Canals. | Other Sources. | Dry. |
| Mainpuri, | Bhongaon, | Bewar, ... | 1879-80 | 2370·9 | 244 | 619·11 | 156·55 | 1351·24 | 68·96 | 10·68 | ... | ... | 764·17 | 140·17 | ... | 5·7 | 656·03 |
| ,, | ,, | ,, | 1880-81 | 2370·9 | 244 | 399·73 | 696·57 | 1030·60 | Nil. | 2·37 | 13·33 | 3·6 | 757·5 | 145·91 | 479·7 | 51·6 | 273·10 |
| ,, | Shikohabad, | Makirabad, | 1879-80 | 423·5 | 61·8 | 75·5 | 56·2 | 230·0 | 96·5 | 11·2 | ... | ... | 211·4 | 76·7 | ... | 1·7 | 81·7 |
| ,, | ,, | ,, | 1880-81 | 423·5 | 64·1 | 26·6 | 100·2 | 232·6 | 29·0 | 2·6 | ... | ... | 206·2 | 62·2 | 39·4 | ... | 27 |

NOTE.—Decrease in culturable area in 1880-81 the first year the canal was open, also that the area of well irrigation was practically unaltered.

## APPENDIX VII.

*Cultivator's Shares in Sitapur Well, Aligarh.*

| Fields. | Area in Bighas. | Crops. | Waterings to date. | Cultivators. | Total. | Rate. Pur. | Rate. Days. | Biswas per day per pur. | Remarks. |
|---|---|---|---|---|---|---|---|---|---|
| 55 | 1-13-0 | Wheat, | 2 | Chita, Polt, | | 7 | | | |
| 44 | 3- 0-0 | ,, | 2 | ,, ,, | | 7 | 3 | 7·3 | Far. |
| ... | 3- 0-0 | Barley & Gram, | 1 | ,, ,, | 9-13-0 | 7 | | | |
| 51 | 1- 3-0 | Wheat, | 2 | Jewa Ram, Brahmin, | | 7 | | | |
| 82 | 1-10-0 | ,, | 2 | ,, ,, ,, | | 7 | 1 | 9 | ,, |
| 49 | 2-14-0 | Barley & Gram, | 1 | ,, ,, ,, | | 7 | 1 | 8 | ,, |
| 67 | 1- 0-0 | ,, | 1 | ,, ,, ,, | | 7 | | | |
| 25/2 | 2- 0-0 | ,, | 1 | ,, ,, ,, | | 7 | 1 | 8·6 | ,, |
| 143 | 2- 3-0 | Wheat, | 2 | ,, ,, ,, | | 7 | | | |
| 141 | 1- 6-0 | ,, | 2 | ,, ,, ,, | | 7 | 2 | 5 | ,, |
| 125 | 4- 0-0 | ,, | 2 | ,, ,, ,, | | 7 | | | |
| 124 91 | 3- 6-0 | ,, | 2 | ,, ,, ,, | | 7 | 3 | 7 | ,, |
| 63 | 2- 1-0 | Barley, | 2 | ,, ,, ,, | | 7 | | | |
| ... | 0- 8-0 | Carrots-Kurr, | 2 | ,, ,, ,, | | 7 | 1 | 13 | Near. |
| 93 | 2- 1-0 | Barley & Gram, | 2 | ,, ,, ,, | 24-1-0 | 7 | | | |
| 53 | 2-10-0 | Wheat, | 2 | Bhura, Herdsman, | | 7 | | | |
| 61 | 2-17-0 | ,, | 2 | ,, ,, ,, | | 7 | 2 | 9 | ,, |
| 80 | 1- 0-0 | Carrots-Kurr, | 2 | ,, ,, ,, | | 7 | | | |
| 68 | 3-14-0 | Wheat, | 3 | ,, ,, ,, | | 7 | 1·6 | 7 | ,, |
| 146 | 5- 0-0 | Barley & Gram, | 2 | ,, ,, ,, | 15-1-0 | 7 | 2 | 7 | ,, |
| 84 | 1- 0-0 | Wheat, | 2 | Ballu, Herdsman, | | 7 | | | |
| ... | 0-12-0 | Carrots-Kurr, | 2 | ,, ,, ,, | | 7 | 2 | 8 | ,, |
| 140 | 4- 0-0 | Wheat, | 2 | ,, ,, ,, | 5-12-0 | 7 | | | |
| 78 | 3- 4-0 | ,, | 2 | Mangta, Herdsman, | | 7 | | | |
| 142 | 1- 9-0 | ,, | 2 | ,, ,, | | 7 | 2 | 7 | ,, |
| ... | 0- 7-0 | Carrots-Kurr, | 2 | ,, ,, | | 7 | | | |
| 151 | 1- 0-0 | Wheat & Barley, | 1 | ,, ,, | | 7 | | | |
| ... | 1-13-0 | Barley & Gram, | 1 | ,, ,, | | 7 | 2 | 7 | ,, |
| 144 | 2- 4-0 | Wheat, | 2 | ,, ,, | 9-17-0 | 7 | | | |
| 85 | 3-13-0 | Wheat & Barley, | 1 | Hulasi, Brahmin, | | 7 | | | |
| 86 | 1-13-0 | Wheat, | 2 | ,, ,, | | 7 | | | |
| 87 | 2- 6-0 | ,, | 2 | ,, ,, | | 7 | | | |
| 88 | 1- 9-0 | ,, | 2 | ,, ,, | | 7 | 3 | 11 | ,, |
| 89 | 1- 7-0 | ,, | 2 | ,, ,, | | 7 | | | |
| 90 | 1- 1-0 | ,, | 1 | ,, ,, | | 7 | | | |
| 62 | 0-12-0 | ,, | 1 | ,, ,, | 12-1-0 | 7 | | | |
| | 74- 5-0 | | | | | | 26·6 | 8 | Mean work per lift. |
| | | | | | | | | 4 | ,, ,, per unit. |

*N. B.*—Two pairs of cattle per lift.

## APPENDIX VIII.

*Kachi Shares on Path Wells, Hamirpur.* 8 *Wells.*

| Number of well. | Name of Kachi. | Share in days. | No. of Proprietors. | Total No. of days. | Area in acres. |
|---|---|---|---|---|---|
| 202 | Nathu, .. | 10 | 1 Lift. | | |
| „ | Bhahwia, .. | 6 | | | |
| „ | Debi, .. | 7 | | | |
| „ | Bisoura, .. | 8 | 4 | 31 | |
| 199 | Teek Ram, .. | 8 | 2 Lifts. | | |
| „ | Chunna, .. | 8 | | | |
| „ | Mukta, .. | 8 | | | |
| „ | Bhabhu, .. | 8 | | | |
| „ | Mulhia, .. | 8 | | | |
| „ | Bindra, .. | 8 | | | |
| „ | Rahuda, .. | 8 | | | |
| „ | Mungli, .. | 8 | | | |
| „ | Bisaura, .. | 8 | | | |
| „ | Kabsu, .. | 6 | | | |
| „ | Debi, .. | 6 | | | |
| „ | Budha, .. | 6 | 12 | 90 | |
| 170 | Bisawra, .. | 3 | 2 Lifts. | | |
| „ | Bisawri, .. | 3 | | | |
| „ | Barauhi, .. | 3 | | | |
| „ | Pershadi, .. | 3 | | | |
| „ | Kurkha, .. | 3 | | | |
| „ | Gouda, .. | 3 | 6 | 18 | |
| 168 | Bisawra, .. | | 1 Lift. 1 | | 1451 |
| 227 | Dhujjra, .. | 3 | Lifts. | | |
| „ | Udut, .. | 3 | | | |
| „ | Musia, .. | 3 | | | |
| „ | Bukht, .. | 3 | | | |
| „ | Purmia, .. | 3 | | | |
| „ | Dusian, .. | 3 | | | |
| „ | Gouri, .. | 3 | | | |
| „ | Mungli, .. | 3 | | | |

| Number of well. | Name of Kachi. | Share in days. | No. of Proprietors. | Total No. of days. | Area in acres. |
|---|---|---|---|---|---|
| 227 (*contd.*) | Nannah, .. | 3 | | | |
| „ | Labbra, .. | 3 | | | |
| „ | Rachhiar, .. | 3 | | | |
| „ | Ghunsam, .. | 3 | | | |
| „ | Haridass, .. | 3 | | | |
| „ | Madeo, .. | 3 | | | |
| „ | Hazari, .. | 3 | | | |
| „ | Mausukh, .. | 3 | | | |
| „ | Behari, .. | 3 | | | |
| „ | Mulna, .. | 3 | | | |
| „ | Bani Ram, .. | 3 | | | |
| „ | Mohan, .. | 3 | | | |
| „ | Ramju, .. | 3 | 21 | 63 | |
| 117 | Adit, .. | 3 | 2 Lifts. | | |
| „ | Dhajjie, .. | 3 | | | |
| „ | Purmia, .. | 3 | | | |
| „ | Mundia, .. | 3 | | | |
| „ | Gori Mal, .. | 3 | | | |
| „ | Labbra, .. | 3 | | | |
| „ | Madari, .. | 3 | | | |
| „ | Racchian, .. | 3 | | | |
| „ | Bukht, .. | 3 | 9 | 27 | |
| 103 1996 | Dhajju, .. | 2 | 2 Lifts. | | |
| „ | Nunpa, .. | 2 | | | |
| „ | Jeora, .. | 2 | | | |
| „ | Ghunsam, .. | 2 | | | |
| „ | Ramchian, .. | 2 | | | |
| „ | Mohan, .. | 2 | 6 | 12 | |
| 102 | Moria, .. | 3 | 1 Lift. | | |
| „ | Mungli, .. | 1 | 2 | 4 | 37·23 |

## APPENDIX IX.

*Statement showing the Progress of Moradabad Wells up to the 11th May, 1882.*

| Village. | Diameter. | Depth to water surface. | Height of masonry. | Depth of pipe below curb. | Height of pipe above curb. | Pipe, wood or iron. | Remarks. |
|---|---|---|---|---|---|---|---|
| *Karanpur I, | 6′ 0″ / 8′ 0″ | 10′ | 38′ 7″ | 82′ | 4′ | Iron 3″ | An old well—cylinder on sand—pipe on clay (by Bellasis)—has been built up and sunk 18′, and pipe sunk—no ballast—not in use. B. test 19 minutes—water reduced 3′ 3″—sand rose 2′ 6″—well cracked. Injured cylinder repaired—well and pipe cleaned. |
| *Karanpur II, | 8′ 0″ / 10′ 10″ | 13′ | 41′ 0″ | 73′ | 11′ | Wood 5″ | Cylinder on sand—pipe on sand and kunkur—no ballast—just completed 21st April, 1882—no test. |
| *Ekonda I, ... | 8′ 4″ / 11′ 3″ | 11′ 6″ | 30′ 7″ | 8′ | Left above W. S. until bottom is put in. | Wood 5″ | Cylinder in sand—pipe in kunkur reef—no bottom—masonry completed 13th April, 1882—pipe 1st May, 1882—no test—kunkur stratum probably 9″ thick. |
| *Ekonda II, | 6′ 0″ / 8′ 0″ | 10′ | 30′ 9″ | Now 20 feet sinking in progress. | In progress. | Wood 5″ | Cylinder on sand—pipe in progress—no bottom—masonry completed 4th April, 1882. |
| Sahadra, ... | 6′ 0″ / 8′ 0″ | 12′ 6″ | 30′ | *Nil.* | *Nil.* | *Nil.* | Well sunk 4th May, 1882—17′ 6″ of water—well 3′ 6″ above ground resting on a layer of blue clay and white boulders 2′ thick, under this 1′ yellow clay and kunkur below sand—hole has been bored through clay to sand 5th May, 1882. |
| Padli, ... | 6′ 0″ / 8′ 0″ | 10′ | 30′ | 8′ | Left above W. S. until bottom is put in. | Wood 5″ | Well resting on sand—tube in clay stratum 1′ thick, into which it has been driven 3″, and a hole bored through to sand—work completed 4th May, 1882. |
| Isapur, ... | ... | ... | ... | ... | ... | ... | No work done, abandoned by orders of Mr. Alexander. |
| Tigiria, ... | ... | ... | ... | ... | ... | ... | Bricks collected do. do. Mr. Benett. |
| Sikri, ... | ... | ... | ... | ... | ... | ... | Do. do. and curb and pit dug do. do., 11th May, 1882. |
| *Hashimpur, | 8′ 8″ / 10′ 8″ | 9′ | 30′ | 30′ | Now 14′ will be cut off when bottom is put in. | Wood 5″ | Cylinder in pure sand—pipe in kunkur, mixed with sand—no bottom—basket and ballast collected—2 purs at work now by assamis—4′ sand came in after 10 days' work—well undisturbed—water supply fair—work was completed last November. |
| *Sadhpur, | 6′ 1″ / 8′ 1½″ | 11′ 8″ | 32′ 5″ | 8′ 7″ | 5′ 3″ | Wood 5″ | Cylinder in pure sand—pipe in sand and kunkur—bottom of basket loaded 4′ in depth with ballast in well—1′ 10″ of ballast in pipe—well tested for 2 hours, 23rd April, 1882 with basket in—well sunk 7″, and cylinder cracked all round 22′ below present top, and lower portion settled 3″ down, letting in a mixture of slush and sand which filled well to 22′ 6″ from present top, the point to which water had been reduced—well has been built up 2′ and left so. |

* These wells are practically useless in their present condition.

APPENDIX IX.—(*Continued*).

*Statement showing the Progress of Moradabad Wells up to the* 11*th May*, 1882—(Continued.)

| Village. | Diameter. | Depth to water surface. | Height of masonry. | Depth of pipe below curb. | Height of pipe above curb. | Pipe, wood or iron. | Remarks. |
|---|---|---|---|---|---|---|---|
| *Muhamdi, ... | $\frac{7'\,6'}{9'\,6''}$ | 11′ 8″ | 31′ 2″ | 21′ 7″ | 10′ | Wood 5″ | Cylinder on pure sand—pipe on sand and kunkur—no bottom—basket and ballast collected—tested 18th February, 1882, for 2 hours—water reduced 3′ 5″ by drawing—187 purs × 3·37 = 630 c. f. + 1′ pump—3′2″ sand came into well and 4′ 9″ to pipe, well did not sink—sand has been cleared out. Tenants have asked permission to use well. |
| *Hayatpur, .. | $\frac{8'\,1\frac{1}{2}''}{10'\,1\frac{1}{2}''}$ | 12′ 8′ | 32′ 8″ | 27′ 5″ | 5′ | Wood 5″ | Cylinder on pure sand—pipe on sand and kunkur—no bottom to well, but 1′ ballast in pipe—basket and ballast collected—tested 28th February, 1882, for 2 hours—185 purs ×3·37 = 624 c. f. + 1′ pump—water surface reduced 3′ 8″—sand 3′ 7″ came into pipe and 4′ 2″ into well—well sunk 1′ 5″—well has since been built up 1′8″—sand removed from well, and sand and ballast from pipe—since experiment well has been used by assamis. |
| Majhola, ... | $\frac{8'\,2''}{10'\,2''}$ | 12′ | 22′ 8″ | 10′ | 5′ | Iron 4½″ | Cylinder on clay—a sloping bed—one side of curb being 6″ above clay—2 feet of ballast in well stopping up this opening. The pipe has recently been driven down to lower clay bed sand layer. Tested with 2 purs 8th May, 1882—after spring had been worked up gave an excellent supply, and after pipe is driven down 2′ will suffice for 4 purs. |
| *Baldana, ... | $\frac{6'}{8'}$ | 9′ 5″ | 27′ 7″ | 30′ | 9′ | Iron 4½″ | Cylinder on fine sand—pipe on coarse sand and kunkur—no bottom—pipe clean—no test except by Mr. Edwards, result not known—well was sunk 4′ with pipe in, which gave a good deal of trouble—clay pipes were formerly tried in this well in two places which interfered with dredger—cost of sinking about Rs. 40—well has never been worked. |
| † Chak Dhanori, | $\frac{6'}{8'}$ | 9′ | 30′ | 55′ 10″ | 10′ | Wood 5″ | Cylinder on sand—pipe in sand and kunkur—experiment recorded—ballast in bottom now being removed from both well and pipe, and experiment with impermeable bottom in progress—concrete in cylinder 4′ 3″ thick—completed 10th May, 1882—17′ of water in well—walls being raised about 2′—pipe will be cleaned out and cut off 6″ above concrete. |
| Rajohan I., ... | $\frac{6'}{8'}$ | 12′ | 30′ | 4′ | 9′ 4″ | Wood 5″ | Cylinder on mota—good spring—pipe clean—4′ ballast in well—experiment recorded—well in use. |
| *Rajohan II., | $\frac{6'}{8'}$ | 10′ 3″ | 31′ 3″ | 36′ 6″ | 12′ 6″ | Wood 5″ | Cylinder on sand—pipe in sand and kunkur—4′ ballast in well—pipe clean—no test since ballast was put in—well in use by assamis. In B, test 2 hours—water surface reduced 5′ 3″ to 5′ 6″—sand came in—well sunk 1″—since built up 2′—ballast added and well cleaned out. |

* These wells are practically useless in their present condition.

† *Vide* para. 156.

APPENDIX IX.—(*Continued*).

*Statement showing the Progress of Moradabad Wells up to the 11th May,* 1882—(Continued.)

| Village. | Diameter. | Depth to water surface. | Height of masonry. | Depth of pipe below curb. | Height of pipe above curb. | Pipe, wood or iron. | Remarks. |
|---|---|---|---|---|---|---|---|
| *Bawan Kheri I., ... | 5′ / 7′ | 10′ | 31′ 3″ | 64′ | 10′ | Wood 3″ | Cylinder on sand—pipe on sand mixed with stone and kunkur—bottom of kunkur ballast 4′ deep—pipe clean; a little used by assamis. B. test 2 hours—water reduced 8′—sand rose 8′ 3″—well sunk 2 feet—since been cleaned out, ballast added and built up. |
| *Bawan Kheri II., ... | 5′ / 7′ | 10′ 1″ | 31′ 2″ | 44′ | 8′ | Wood 5″ | Cylinder on sand—pipe on sand and kunkur—4′ ballast in well—pipe clean—no test since ballast—only worked by dhenklis. B. test 2 hours—well sunk 1′—sand rose 6′ 2″—water fell 5′—well has since been raised 1′ 6″, cleaned and ballast put in. |
| *Bahadurpur, | 6′ / 8′ | 10′ 4″ | 31′ 6″ | 27′ 1″ | 12′ | Wood 5″ | Cylinder on sand—tube on sand and kunkur—4′ ballast in well—pipe clean. B. test 2 hours—well sunk 9″—sand rose 5′ 9″—water fell 5′ 6″—well has since been raised 1′ 6″, cleaned and ballast added. |
| *Dehri Jat I., | 6′ / 8′ | 9′ 3″ | 32′ 3″ | 28′ | 7′ | Wood 5″ | Cylinder on sand—pipe in sand and kunkur 4′ ballast in well—pipe clean—no test since ballast—in use 1 pur. B. test 2 hours—water reduced 4′ 6″—sand rose 4′ 7″—well did not sink during test—well cleared—ballast added—well built up. |
| *Dehri Jat II., | 6′ / 8′ | 9′ 6″ | 31′ | 55′ 9″ | 6′ | Wood 5″ | Cylinder on sand—pipe in sand and kunkur—4′ ballast—pipe clean—no test since—well not in use. B. test 2 hours—water reduced 6′ 2″—sand rose 7′ 11″. Since test well cleared—ballast added—well built up 1′. |
| *Rampur, ... | 8′ 2″ / 4′ | 23′ 4″ | 43′ 8″ | 54′ 6″ | Left above W. S. until bottom is put in. | Wood 5″ | Cylinder on sand—pipe on sand and clay mixed with kunkur—no ballast, has never been tested—masonry completed 15th April, 1882. This well is on a sandy ridge on edge of bangar. |
| *Manota, ... | 6′ / 8′ | 14′ 9″ | 32′ 10″ | 16′ 4″ | | Wood 5″ | Cylinder on sand—pipe on a 9″ stratum of clay and kunkur—never tested.<br>Masonry completed 17th April, 1882.<br>Pipe „ 30th April, 1882. |

* These wells are practically useless in their present condition.

## APPENDIX X.

*Extracts from Diary.*

| District. | Perganna. | Village. | Distribution of the Mota. | Life in years of kucha wells. | Remarks. |
|---|---|---|---|---|---|
| Cawnpore. | Jájmau, ... | Bidnu, ... | General, ... | 10 | Sand stratum overlies mota, to which kucha wells rarely reach; they fail to give water in very dry years. Dry brick wells common. |
| | ,, ... | Khirsa, ... | ,, ... | 10 | All irrigating wells kucha, which fail in dry years—5 feet sand layer over mota. |
| | Ghatampur, ... | Gutchupur, ... | Scattered, ... | 1 | A little canal irrigation—village lands much flooded in rains, and subsoil water rises to within 6 or 8 feet of the surface of the ground—kucha wells supposed impossible, but one now being dug which will cost Rs. 5 per acre irrigated. Masonry wells mostly percolation, and not much used for irrigation. |
| | Akbarpur, ... | Niganjassi, ... | General, ... | ... | Close to Ganges Canal—springs raised 5 feet—sand layer 5 feet thick over mota, which renders kucha wells difficult to build—the one pucka well in the village being used to-day for the first time for 5 years for irrigation—no kyaries being made—see No. 20 for result. Depth to mota variable, about 50 feet. |
| | ,, ... | Jalalpur, ... | ,, ... | ... | Close to Niganjassi. Mota found at depths varying from 40 to 70 feet—kucha wells don't answer. A Bunnia in this village bought an 8 pur pucka well for Rs. 32 at auction, and charges Re. 1 per acre for irrigation. |
| | Jájmau, ... | Chachendi, ... | ,, ... | 5 | Kucha wells last 5 years if repaired—canal has raised subsoil water level—sand over mota—many kucha wells. |
| | Bilhaur, ... | Bilhaur, ... | Universal, ... | 20 | Mota 75 feet—many kucha wells—a great deal of *dofasli* area, owing to Kachi cultivators. |
| Unao. | Unao, ... | Unao, ... | General, ... | 10 | Supply bad, water surface having fallen lately—masonry wells much affected, and number of lifts reduced—kucha wells only last one year if not repaired. |
| | Moha, ... | Daryaganj, ... | Doubtful, ... | *x* | Supply bad—a good deal of tank irrigation—no cattle employed, but men lagor with a *gurrah*. |
| Lucknow. | Lucknow, ... | Banthra, ... | Local, ... | ... | Kucha wells last from 1 to 10 years; in Hamirpur the next village they do not answer. The zemindar is building dry brick wells with advances which promise well. |
| | ,, ... | Hamirpur, ... | ,, ... | *Nil.* | See above—one good masonry well in village worked by men lagor—more badly wanted, and the people anxious for them. |
| | Mulleabad, ... | Mulleabad, ... | Above water surface, ... | ... | The clay bed here lies above the water surface—the water supply is good, but wells frequently fail—both classes used. |

APPENDIX X.—(*Continued*).

*Extracts from Diary*—(Continued).

| District. | Perganna. | Village. | Distribution of the Mota. | Life in years of kucha wells. | Remarks. |
|---|---|---|---|---|---|
| Hardui. | Mulleabad, ... | Rahimganj ... | General, ... | 2 | Dry brick wells common—no sand above mota. |
| | Sandíla, ... | Sandíla, ... | „ .. | 2 | Only 1 lift wells possible as supply inferior—sand lies above mota—human and cattle labor used. |
| | „ ... | Ghousganj, ... | Unknown, ... | 1 | Principally ráti lifts—no churrus irrigation. Sye nadi banded *for irrigation*—strata all sand. Kili practised in Mallawan near this on the bangar. |
| | „ ... | Ansanpur, ... | „ ... | 1 | In Ganges khadir same conditions as above, but dhenklis not rátis used. |
| | Sumerpur, ... | Sumerpur, ... | Not known, | *Nil.* | Only parwa soil irrigated mainly by Kachis near village—supply in wells fair—wells in hár only used for drinking purposes, and are necessary on account of the great area of village. |
| | Maudah, ... | Maudah, ... | „ ... | ... | Same remarks as for Sumerpur. In már soil, if the September rain fails, the crops are excellent, and cold weather rains not desirable—plenty of wells in hár, but not used for irrigation. |
| | Mahoba, ... | Bugwa, ... | „ ... | ... | Rock met with as close to hills—supply bad—dependent on small tank now nearly empty—irrigation not confined to Abadi, as little már exists. |
| | „ ... | Mahoba, ... | „ ... | 1 | Canal and well irrigation—wells tank fed—no már soil—kucha dhenkli wells used near lake—well crops mostly garden and tobacco. |
| Hamirpur. | „ ... | Busora, ... | „ ... | ... | Rock wells—irrigation general—barley irrigated often six times—supply poor. |
| | Panwári, ... | Kalpahár, ... | „ ... | 20 | Wells tank fed—no canal from tank—kucha wells last many years—irrigation round village, but grain crops are irrigated. |
| | „ ... | Deoganpura, ... | „ ... | *Nil.* | No kucha wells—water surface falls in hot weather—irrigation only round village—garden crops and tobacco. |
| | „ ... | Panwári, ... | „ ... | ... | Do. do. do. |
| | „ ... | Alipura, ... | „ ... | ... | Only one irrigating well in village—soil kabur, the only instances I have seen of its being irrigated. |
| | Jaitpur, ... | Jaitpur, ... | „ ... | 3 | Wells tank fed—all classes used—rock wells common. Rabi generally irrigated, and sugar in kharif—canal from tank. |
| | „ ... | Morari, ... | „ ... | ... | Do. do. do. |
| | Ráth, ... | Ráth, ... | *Nil.* | 1 | Rabi irrigation round town—gardens and tobacco, opium, &c.—water supply good—sugar irrigated in hár by kucha and pucka wells, principally kucha, as the same field is at most used every third year for sugar, and the well is specially dug—grain crops not watered in hár. |

APPENDIX X.—(*Continued*).

*Extracts from Diary*—(Continued).

| District. | Perganna. | Village. | Distribution of the Mota. | Life in years of kucha wells. | Remarks. |
|---|---|---|---|---|---|
| Hamirpur. | Ráth, ... | Jureya, ... | *Nil.* | ... | Six masonry wells in village : three good, one fallen in, two in bad order. Water surface = 80 feet. 11,000 inhabitants. These wells cost a large sum, and need little expensive repair—water is drawn by a churrus with cattle for both drinking and a little garden cultivation. |
| | Jalálpur, ... | Chandaut, ... | ... | ... | Water surface 113 feet—water drawn by churrus for both drinking and irrigation, of opium and garden—four wells in village—three in hár—(water surface 56 feet)—used for sugar. |
| Farukhabad. | Kanoge, ... | Sarai Mírán, ... | Local, ... | 20 | Water surface 60 feet—kucha wells much used, not lined, but can only be built in certain localities—crops grain. |
| | Chibrámau, ... | Ghursaháiganj, | General, ... | 20 | Good kucha wells—all crops watered—no masonry irrigating wells. |
| | ,, ... | Deobarmpur, ... | Universal, ... | 20 | Kucha wells last if repaired—seven have fallen in since canal came, but cultivators say that they would have stood if repaired—canal and well irrigation carried on in adjoining fields. Kucha wells can be made permanent by a lining of dry bricks below. |
| | Imratpur, ... | Rajaipur, ... | Unknown, ... | 2 | No churrus irrigation—dhenklis common—mota unknown except in a few local places which have escaped the Ramgunga action. Water surface 15 feet. |
| | Fatehgarh, ... | Khampur, ... | General, ... | 60 | Water surface 60 feet—no lining required for kucha wells—no masonry irrigating wells—double cropped area large. |
| | ,, ... | Tajpur, ... | ,, ... | 20 | Water surface 40 feet. Do. do., areas in this village and in Khampur often treble cropped. Potatoes give often 20 maunds to the acre. |
| | Bhongaon, .. | Bewar, ... | Local, ... | 5 | Kucha wells not injured by canal if repaired with dry brick—subsoil surface raised 3 to 5 feet by canal. |
| Mainpuri. | Mainpuri, | Bonamia, ... | General, ... | ... | Kucha wells not much used—masonry wells up to 4 pur supply excellent—wells fully worked—all crops watered—three villages have high class lagor irrigation. |
| | | Jugrupur, ... | ,, | | |
| | | Hasanpur, ... | ,, | | |
| | | Sansarpur, ... | ,, | | |
| | Ghiror, ... | Ghiror, ... | Local, ... | 2 | Close to canal—supply bad as wells not cleaned out. Water surface raised 6 to 8 feet by canal—kucha wells require a lining of grass rope. |
| | Shikohabad, ... | Mahirabad, ... | General, ... | 1 | Water surface raised by canal—soil sandy—kucha wells formerly universal, now only last one year—a good situation for Government wells, as the kucha wells do not now reach the mota. |

APPENDIX X.—(*Continued*).

*Extracts from Diary*—(Continued).

| District. | Perganna. | Village. | Distribution of the Mota. | Life in years of kucha wells. | Remarks. |
|---|---|---|---|---|---|
| Mainpuri. | Shikohabad, ... | Shikohabad, ... | General, ... | 1 | Near Sirsa nadi—kucha wells only last one year as they are injured by floods. |
| | ,, ... | Mustpur, ... Darapur, ... | ,, ... | 1 | Close to Lower Ganges Canal—formerly kucha wells not used. Now owing to rise in water surface they are dug as percolation. Good masonry wells exist—mota at 60 feet. Heavy rabi command as kharif failed. |
| | ,, ... | Ramnagar, ... | ,, ... | Varies. | Kucha wells close to canal impossible, but are dug half a mile away—dry brick wells abound—supply increased by canal percolation—cultivators admit benefit—high class irrigation. |
| | ,, ... | Gopalpur, ... | ,, ... | ,, | Wells generally lined with dry brick near canal, but water surface does not vary—mixed irrigation—low class. |
| | ,, ... | Gurra muzra oore sur, ... | Scarce, ... | 3 | Kucha wells require lining—joint irrigation common—low class. |
| Etah. | Sukeet, ... | Chachena Mubarikpur, ... | Local, ... | ... | Localization of mota marked—wells in clusters—depth to mota varies from 30 to 60 feet—kucha wells not much used, as many pucka wells are now unused owing to canal. Irrigation low class—supply good. Canal water might with advantage be debarred where masonry wells are plentiful, and advances given where the mota is distant. |
| | Etah, ... | Bagipur, ... | ,, ... | ... | Kucka wells not possible—subsoil bad—plenty of masonry wells. Kili first seen here so south—irrigation good—supply plentiful. |
| | Márehra, ... | Tillokpur, ... | General, ... | 10 | High land irrigated from wells; low from canal—mota at 36 feet—crops splendid—some wheat measured 5 *feet* 4 *inches in height* and still growing—kucha wells require lining as sand lies above mota. |
| Aligarh. | Secunder Rao, ... | Secunder Rao, ... | ,, ... | *x* | Kucha dhenkli wells in low ground—many masonry wells—supply and irrigation good—canal irrigated area large. |
| | ,, ... | Gopi, ... | ,, ... | 3 | Recently debarred from canal water—many masonry wells—kucha last 3 years—supply plentiful and bullocks good—mota at 33 feet. |
| | ,, ... | 17 villages, ... | ,, ... | ... | Have been recently debarred from canal water—many dry brick wells badly built, but giving good supply—have been constructed this year without advances—former irrigated area appears nearly worked up to—went with Mr. Lang, C.S., Collector, to search for spread of usar, but could find no increase. |

APPENDIX X.—(*Continued*).

*Extracts from Diary*—(Continued).

| District. | Perganna. | Village. | Distribution of the Mota. | Life in years of kucha wells. | Remarks. |
|---|---|---|---|---|---|
| Aligarh. | Secunder Rao, ... | Nanu, ... | General, ... | ... | Kucha wells lined with wood—last 20 years—little trouble with sand—close to canal—depth to mota varies from 35 to 42 feet. |
| | Aligarh, ... | Dodpur, ... | „ ... | 2 | Far from canal—mota thin in places—one well has sunk through, and though it was formerly 4-lift, now only gives a bad supply for one lift—irrigation high class. |
| | Háthras, | Bijari, ... | „ ... | 2 | Water surface has sunk 6 feet in last 5 years. Masonry wells not much used in consequence—kucha give fair supply—mota at 30 feet—water surface now often 36 feet or below mota. |
| | | Sasni, ... | | | |
| | „ ... | Ramupur, ... | „ ... | 5 | Water surface has fallen 4 feet in last 4 years—same remarks as for Sasni. |
| | | Háthras, ... | | | |
| | Iglás, ... | Sitapur, ... | „ ... | 2 | Four layers of mota exist at 30 feet, 39 feet, 63 feet and 78 feet—kucha wells few—give bad supply, as they only reach 30 feet mota—masonry wells formerly sunk to 63 feet mota, but since 1877 this has ceased to give an abundant supply—wells on 78 feet mota give a splendid supply, and two 8-lift are worked. Water surface fallen 6 to 8 feet since 1877. |
| | „ ... | Iglás, ... | „ ... | 2 | Same remarks as for Sitapur. |
| | Atrauli, ... | Atrauli, ... | Local, ... | ... | Mota local—where clay found kucha wells last many years—masonry wells plentiful, and irrigation good—no fall in water surface, though the natural supply is not supplemented. |
| Muttra. | Sadabad, ... | Sadabad, ... | General, ... | 5 | Kucha wells extensively used. |
| | „ ... | Munsia, ... | „ ... | ... | Ditto ditto also many good masonry wells—water surface has fallen 6 feet. |
| | Maháboid, ... | Nirhauli, ... | Deep, ... | 8 | Wells both masonry and kucha said to be percolation. Water surface 60 feet—work lagor—though in other Muttra villages only kili seen—water surface has fallen. |
| | „ | Chauli, ... | Local, ... | 8 | Mota at 78 feet—a 2-lift masonry well costs Rs. 1,200—water khara—crops and irrigation good. |
| | | Amirpur, ... | „ | | |
| Bulandshahr. | „ ... | Gonga (Raya) | General, ... | 8 | Many masonry wells near this injured by the excessive fall in water surface, *i.e.*, 15 feet, which has left the mota dry. Kucha wells last if cared for—irrigation and crops good. |
| | | Dhomia, ... | „ ... | ... | |
| | | Lehara, ... | „ ... | ... | |
| | Dibai, ... | Bajutpur, ... | „ ... | 20 | Mota at 42 feet—well irrigation slack as canal is near—good clay subsoil. |

APPENDIX X.—(*Continued*).

*Extracts from Diary*—(Continued).

| District. | Perganna. | Village. | Distribution of the Mota. | Life in years of kucha wells. | Remarks. |
|---|---|---|---|---|---|
| Bulandshahr. | Anupshahr, ... | Anupshahr, ... | General, ... | ... | Mota at 50 to 60 feet—soil above sandy—water surface at 36 feet—kucha wells impossible—masonry often not used for irrigation as they don't reach the mota—soil poor—and much cut up by ravines. |
| | ,, ... | Jetwai, ... | Unknown, ... | 6 | Mota occurs in adjoining villages—kucha wells last when lined, but much dry land. |
| | ,, ... | Gynali, ... | Local, ... | ... | Mota at 30 feet, but not found in many places—people anxious for wells. |
| | Baran, ... | Chandpur, ... | General, ... | ... | Masonry and kucha wells lined with wood last well, though canal is near. Water surface has risen 5 feet. |
| | | Tatarpur, .. | ,, | | |
| | | Jasrauli, ... | ,, | | |
| | | Bulandshahr,... | ,, | | |
| | Agoutah, ... | Chabrawat, ... | ,, ... | ... | Little well irrigation, as area fully commanded by canal. |
| | ,, ... | Aoleduh, ... | ,, ... | *Nil.* | Mota here at 38 feet, but one well was sunk 78 feet without finding it. Sand not usual above mota, but bad clay renders kucha wells impossible—irrigation combined well and canal—water surface has risen 3 feet. |
| Meerut. | Hápur, ... | Hápur, ... | Local, ... | 4 | Mota at 24 feet—kucha and pucka wells used—many failures of wells on account of not finding mota—irrigation eagerly practised, but not always available. |
| | Serawuh, ... | Kurkauda, ... | General, ... | ... | Kucha wells don't answer—no canal—mota at 27 feet—irrigation general—crops and cultivation good. |
| | ,, ... | Kurkuri, ... | ,, ... | ... | More sand over mota, which is not so universal—same remarks as for Kurkauda, which is the next village. |
| | Meerut, ... | Meerut, ... | ,, ... | *x* | Both masonry and kucha wells used—water supply medium—mota at 40 feet, but varies. |
| Muzaffarnagar. | Khátauli, ... | Khátauli, ... | Local, ... | ... | Mostly canal irrigated—rabi crops not much watered from wells—sugarcane sometimes—mota at 30 to 60 feet, but no new wells now sunk. |
| | Jansath, ... | Jauli, ... | ... | ... | No well irrigation, when canal water not available rabi is grown dry. Water surface 20 feet. |
| | Muzaffarnagar, | ... | ... | ... | Partly debarred from canal water, but little rabi watered from wells, and that grown dry was very fair. Water surface 20-27 feet—gardens occasionally watered. |
| Saharanpur. | Manglaur, ... | Mahmudpur, ... | ... | ... | Same remarks as for Jauli. |
| | Roorkee, ... | Roorkee, ... | Local, ... | 4 | Wells used for garden crops—mota very local—lagor irrigation—kucha wells last when lined—irrigation not necessary for rabi in good years. |

## APPENDIX X.—(*Continued*).

*Extracts from Diary*—(Continued).

| District. | Perganna. | Village. | Distribution of the Mota. | Life in years of kucha wells. | Remarks. |
|---|---|---|---|---|---|
| Bijnor. | Bijnor District, | ... | ... | ... | The mota is only found in the Chandpur Tahsil, where sugarcane is extensively watered—rabi does not require irrigation in years of fair rainfall, and is rarely given more than one watering—kucha dhenkli wells are used for gardens. |
| | Najíbabad, ... | Najíbabad, ... | Unknown, ... | ... | Baghs watered by churrus lagor—subsoil mixed clay and sand, and if wells are sunk too deep, they pass the water-bearing strata into a dry one. Water surface = 30 feet. |
| | Nagína, ... | Nagína, ... | „ .. | x | Dhenkli irrigation for gardens from kucha wells. Water surface = 9 to 23 feet. |
| | Chandpur, ... | Níhtor, ... | „ ... | ... | Dhenkli irrigation for gardens from all classes of wells. Water surface = 16 to 25 feet. |
| | „ ... | Pheona, ... | Local, ... | 10 | Good kucha wells are filled with clay to protect them during the rains—mota at 13 to 20 feet.<br>*N.B.*—The mota is most abundant in the Northern Districts, where a depression occurs surrounded by sand hills. |
| | Burpur, ... | Nurpur, ... | Very scarce, | 2 | Churrus irrigation only used for sugarcane from kucha wells giving a small supply—rabi would be given one watering if good wells were available—gardens watered by dhenklis. |
| Moradabad. | Amroha, ... | Amroha, ... | Local, ... | 3 | Mota common near the town—both pucka and kucha used for irrigation—worked kili—grain crops watered once as a rule when a well is available—mota at 17 to 25 feet. |
| | „ ... | Rajabpur, ... | Unknown, ... | 1 | No churrus irrigation—Government wells in progress near this—dhenkli irrigation common—the mota has been found at 30 feet near this. |
| | „ ... | Burhunpur, ... | „ .. | 1 | Only dhenkli irrigation here, but purs are worked in the surrounding villages, though the mota is very scarce. |
| | Moradabad, ... | Moradabad, ... | Local, ... | ... | The mota is found I believe, but only dhenklis are worked. |
| | „ ... | Burwala, ... | „ ... | ... | Near the Kosi the mota is known, but there is no churrus irrigation, nor is it wanted in ordinary years. |
| Bareilly. | Fatehganj ... | Fatehganj, ... | Unknown, ... | ... | Garden irrigation by dhenklis. |
| | Bareilly, ... | Kiror, ... | Local, ... | ... | The churrus in masonry and dhenkli in kucha wells are used—supply good—*kili* work. |
| | Nawábganj, ... | Nawábganj, ... | „ ... | ... | Dhenkli and ráti irrigation—no churrus used—water 10 feet from the surface. |

APPENDIX X—(*Continued*).

*Extracts from Diary*—(Continued).

| District. | Perganna. | Village. | Distribution of the Mota. | Life in years of kucha wells. | Remarks. |
|---|---|---|---|---|---|
| | Pilibhit District, | ... | ... | ... | The mota is practically unknown—ráti and dhenklis are used for gardens, &c. |
| — | Banda, ... | Indalpur, ... | Scarce, ... | ... | Mota line of indurated sand, called "Nagasan." Water surface 12 feet—no churrus, only dhenkli irrigation, but wheat is watered. |
| Shahjahanpur. | Pawaine, ... | Dhurmangatpur, ... | Local, ... | 2 | Water surface has sunk 5 feet lately—both kucha and masonry wells used—wheat watered once—sugarcane a good deal cultivated—mota called "mat buroa," as it is mixed with sandy kunkur—gardens also watered with churrus, both human and cattle labor employed. |
| | Sháhjahánpur, ... | Sháhjahánpur, | „ ... | ... | |
| | Jellalabad, ... | Jellalabad, ... | „ ... | 1 to 100 | Only one plot of mota known, in which rátis work—no churrus irrigation—the Ramgunga has cut away nearly all the original soil, but its deposit becomes fertile in 2 years. |

## APPENDIX XI.

*Showing the loss of Head in Pipes of various sizes.*

| Diameter in inches. | Diameter in feet. | Area in square feet. | Velocity in feet per second. | $\frac{V^2}{2g}$ | Loss at end of pipe $= 1{\cdot}5\ \frac{v^2}{2g}$. | Co-efficient for clean pipes = C. | Loss of head per foot of pipe $= C\ \frac{4}{d}\ \frac{v^2}{2g}$. | Loss of head due to friction in 100 feet of clean pipe. | Loss of head due to friction in 100 feet of rough pipe. | Total loss of head in 100 feet of rough pipe. |
|---|---|---|---|---|---|---|---|---|---|---|
| 3 | 0·25 | 0·049 | 6·79 | 0·716 | 1·07 | 0·00667 | 0·0764 | 7·64 | 15·28 | 16·35 |
| 4 | 0·33 | 0·087 | 3·82 | 0·227 | 0·34 | 0·00625 | 0·007 | 1·70 | 3·40 | 3·74 |
| 5 | 0·42 | 0·136 | 2·44 | 0·093 | 0·14 | 0·00600 | 0·0053 | 0·53 | 1·06 | 1·20 |
| 6 | 0·50 | 0·196 | 1·69 | 0·044 | 0·066 | 0·00583 | 0·0021 | 0·21 | 0·42 | 0·49 |
| 12 | 1·00 | 0·785 | 0·42 | 0·003 | 0·005 | 0·00542 | 0·000061 | 0·0061 | 0·012 | 0·007 |

This Table, prepared by Mr. W. Wilson, Assistant Engineer on Special Duty, Department of Agriculture and Commerce, gives the loss of head in pipes of various sizes for a discharge of $\frac{1}{3}$ of a cubic foot per second, and is most interesting, as it shows that the effect of a 3-inch pipe, 100 feet long, is to nullify 16 feet of head, or what would be probably the maximum head in most wells. I am of opinion that he has under-estimated the loss in the case of rough pipes, certainly for wooden ones, such as used in the Moradabad wells.

Pipes can be most usefully employed in cases when it is too expensive to carry the cylinder down to the mota, or where the mota is at a considerable depth, and too thin to support the well directly, in both cases the pipe head should be firmly fixed in concrete.

## APPENDIX XII.

*Canal Water Rates, North-West Provinces.*

| Class. | Nature of Crops. | Per acre irrigated. Flow. R. | A. | P. | Lift. R. | A. | P. | Per |
|---|---|---|---|---|---|---|---|---|
| | *I.—Ganges and Eastern Jumna Canals.* | | | | | | | |
| I. | Sugarcane and rice, ... ... ... ... | 5 | 0 | 0 | 3 | 5 | 4 | Year. |
| II. | Tobacco, opium, vegetables, gardens, orchards and water-nuts, | 3 | 0 | 0 | 2 | 0 | 0 | Crop. |
| III. | All rabi crops, indigo and cotton, ... ... ... | 2 | 4 | 0 | 1 | 8 | 0 | „ |
| IV. | All kharif crops not specified above, ... ... ... | 1 | 10 | 0 | 1 | 0 | 0 | „ |
| | *II.—Lower Ganges and Agra Canals.* | | | | | | | |
| I. | Sugarcane and rice, ... ... ... ... | 6 | 10 | 8 | 3 | 5 | 4 | Year. |
| II. | Tobacco, opium, vegetables, gardens, orchards and water-nuts, | 4 | 0 | 0 | 2 | 0 | 0 | Crop. |
| III. | All rabi crops, indigo and cotton, ... ... ... | 3 | 0 | 0 | 1 | 8 | 0 | „ |
| IV. | All kharif crops not specified above, ... ... ... | 2 | 0 | 0 | 1 | 0 | 0 | „ |

J. CLIBBORN, Capt., B.S.C.,
*Executive Engineer.*

TABLE D.—*Showing periods of Crop growth, mean waterings and intervals.*

| District. | WHEAT. | | | | | | | | | | | | BARLEY. | | | | | | | | | | | | SAFFLOWER | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | January. | February. | March. | April. | May. | June. | July. | August. | September. | October. | November. | December. | January | February. | March. | April. | May. | June | July. | August. | September. | October. | November. | December. | January. | February. | March. | April | May. | June. | July | August | September | October. | November. | December. |
| Cawnpore, ... | | | | | | | 3 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Hamirpur, ... | | | | | | | | | | | | | | | | | | 6 | | | | | | | | | | | | | | | | | | |
| Farukhabad, ... | | | | | | | 4 | | | | | | | | | | | 2 | | | | | | | | | | | | | | | | | | |
| Mainpuri, ... | | | | | | | 3 | 39 | | | | | | | | | | 2 | 43 | | | | | | | | | | | | | | | | | |
| Etah, ... | | | | | | | 4 | 45 | | | | | | | | | | 3 | 30 | | | | | | | | | | | | | | | | | |
| Aligarh, .. | | | | | | | 4 | 42 | | | | | | | | | | 3 | 33 | | | | | | | | | | 3 | | | | | | | |
| Bulandshahr, ... | | | | | | | 4 | ... | | | | | | | | | | 3 | | | | | | | | | | | 3 | | | | | | | |
| Meerut, ... | | | | | | | 4 | 64 | | | | | | | | | | 3 | 60 | | | | | | | | | | 3 | | | | | | | |
| Muzaffarnagar, ... | | | | | | | 4 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Saharanpur, ... | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Bijnor, ... | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Moradabad, ... | | | | | | | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Shahjahanpur, ... | | | | | | | 1 | | | | | | | | | | | 2 | | | | | | | | | | | | | | | | | | |
| Muttra, ... | | | | | | | 5 | 44 | | | | | | | | | | 3 | 60 | | | | | | | | | | 5 | | | | | | | |
| Pillibhit, ... | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Unao, ... | | | | | | | 4 | ... | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Lucknow, ... | | | | | | | 3 | 30 | | | | | | | | | | 2 | | | | | | | | | | | | | | | | | | |
| Hardui, ... | | | | | | | 2 | 30 | | | | | | | | | | 2 | | | | | | | | | | | | | | | | | | |
| Mean Waterings, No. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| „ Interval, days, | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

TABLE D.—*Showing periods of Crop growth, mean waterings and intervals.*

| District. | GRAM | | | | | | | | | | | | OATS. | | | | | | | | | | | | PEAS. | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | January. | February. | March. | April. | May. | June. | July. | August. | September. | October. | November. | December. | January. | February. | March. | April. | May. | June. | July. | August. | September. | October. | November. | December. | January. | February. | March | April. | May. | June. | July | August. | September. | October. | November. | December. |
| Cawnpore, ... | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Hamirpur, ... | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Farukhabad, ... | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Mainpuri, ... | | | | | | | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Etah, . | | | | | | | | | | | | | | | | | | 6 | | | | | | | | | | | | | | | | | | |
| Aligarh, ... | | | | | | | 1 | | | | | | | | | | | 6 | | | | | | | | | | | 2 | | | | | | | | |
| Bulandshahr, ... | | | | | | | 2 | | | | | | | | | | | 6 | | | | | | | | | | | 2 | | | | | | | | |
| Meerut, ... | | | | | | | 1 | | | | | | | | | | | 4 | | | | | | | | | | | 2 | | | | | | | | |
| Muzaffarnagar, ... | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Saharanpur, ... | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Bijnor, .. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Moradabad .. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Shahjahanpur, .. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Muttra, ... | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Pilibhit ... | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Unao, .. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Lucknow ... | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Hardui, ... | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

Mean Waterings, No.
" Interval, days

Mean Waterings, No.
" Interval, days,

Mean Waterings, No.
" Interval, days,

PLATE XI.

TABLE D.—*Showing periods of Crop growth, mean waterings and intervals.*

| District. | CARROTS. | | | | | | | | | | | | POTATOES. | | | | | | | | | | | | OLIUM. | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | January. | February. | March | April. | May. | June. | July. | August. | September. | October. | November. | December. | January. | February. | March. | April. | May. | June. | July. | August. | September. | October. | November. | December. | January. | February. | March. | April. | May. | June. | July. | August. | September. | October. | November. | December. |
| Cawnpore, ... | | | | | | | | | | | | | | | | | 12 | | | | | | | | | | | | 6 | | | | | | | |
| Hamirpur, ... | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 8 | | | | | | | |
| Farukhabad, ... | | | | | | | | | | | | | | | | | 10 | | | | | | | | | | | | 8 | | | | | | | |
| Mainpuri, ... | | | | 10 | | | | | | | | | | | | | 10 | | | | | | | | | | | | 10 | | | | | | | |
| Etah, ... | | | | 9 | | | | | | | | | | | | | | | | | | | | | | | | | 9 | | | | | | | |
| Aligarh, ... | | | | 5 | 20 | | | | | | | | | | | | 4 | | | | | | | | | | | | 10 | | | | | | | |
| Bulandshahr, ... | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Meerut, ... | | | | 6 | | | | | | | | | | | | | 10 | 10 | | | | | | | | | | | | | | | | | | |
| Muzaffarnagar, ... | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Saharanpur, ... | | | | | | | | | | | | | | | | | | 20 | | | | | | | | | | | | | | | | | | |
| Bijnor, ... | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Moradabad, ... | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Shahjahanpur, ... | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Muttra, ... | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Pillibhit, ... | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Unao, ... | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 10 | | | | | | | |
| Lucknow, ... | | | | | | | | | | | | | | | | | 9 | | | | | | | | | | | | 6 | | | | | | | |
| Hardui, ... | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 5 | | | | | | | |

Mean Waterings, No.
„ Interval, days,

Mean Waterings, No.,
„ Interval, days,

Mean Waterings, No.,
„ Interval, days,

PLATE XII.

TABLE D.—*Showing periods of Crop growth, mean waterings and intervals.*

| District | INDIGO. January. | February. | March. | April. | May. | June. | July. | August. | September | October. | November. | December. | COTTON. January | February. | March. | April. | May. | June. | July. | August. | September | October. | November | December. | SUGARCANE. January. | February. | March | April. | May. | June | July. | August. | September | October. | November. | December. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cawnpore .. | 2 | | | | | | | | | | | | | 2 | | | | | | | | | | | | | | | 4 | | | | | | | | |
| Hamirpur, .. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Farukhabad, .. | | | | | | | | | | | | | | | | | | | | | | | | | | | | 6 | | | | | | | | |
| Mainpuri, ... | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Etah, .. | | | | | | | | | | | | | | | | | | | | | | | | | | | | 4 | | | | | | | | |
| Aligarh, ... | | | | | | | | | | | | | | 2 | | | | | | | | | | | | | | 3 | | | | | | | | |
| Bulandshahr, ... | | | | | | | | | | | | | | 2 | | | | | | | | | | | | | | 4 | | | | | | | | |
| Meerut. ... | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Muzaffarnagar, .. | | | | | | | | | | | | | | | | | | | | | | | | | | | | 5 | | | | | | | | |
| Saharanpur, ... | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Bijnor, ... | | | | | | | | | | | | | | | | | | | | | | | | | | | | 3 | | | | | | | | |
| Moradabad, ... | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Shahjahanpur, ... | | | | | | | | | | | | | | | | | | | | | | | | | | | | 4 | | | | | | | | |
| Muttra, ... | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Pillibhit ... | | | | | | | | | | | | | | | | | | | | | | | | | | | | 2 | | | | | | | | |
| Unao. ... | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Lucknow. . . | | | | | | | | | | | | | | | | | | | | | | | | | | | | 10 | | | | | | | | |
| Hardui, ... | | | | | | | | | | | | | | | | | | | | | | | | | | | | 8 | | | | | | | | |
| Mean Waterings, No. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| „ Interval, days, | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

PLATE XIII.

TABLE D.—*Showing periods of Crop growth, mean waterings and intervals.*

| District. | TOBACCO. January. | February. | March. | April. | May. | June. | July. | August. | September. | October. | November | December. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cawnpore, ... | | | | | | 12 | 12 | | | | | |
| Hamirpur, ... | | | | | | 6 | 20 | | | | | |
| Farukhabad, ... | | | | | | 10 | 5 | | | | | |
| Mainpuri, ... | | | | | | 11 | | | | | | |
| Etah, ... | | | | | | | | | | | | |
| Aligarh, ... | | | | | | 10 | | | | | | |
| Bulandshahr, ... | | | | | | 9 | 5 | | | | | |
| Meerut, ... | | | | | | 8 | | | | | | |
| Muzaffarnagar, ... | | | | | | | | | | | | |
| Saharanpur, ... | | | | | | | | | | | | |
| Bijnor, ... | | | | | | | | | | | | |
| Moradabad, ... | | | | | | 30 | 4 | | | | | |
| Shahjahanpur, ... | | | | | | 20 | 8 | | | | | |
| Mattra, ... | | | | | | | | | | | | |
| Pillibhit, ... | | | | | | | | | | | | |
| Unao, ... | No information. | | | | | | | | | | | |
| Lucknow, ... | " " | | | | | | | | | | | |
| Hardui, ... | " " | | | | | | | | | | | |

| GENERAL AVERAGE. | January. | February. | March. | April. | May. | June. | July. | August. | September. | October. | November. | December | Mean number of Waterings. | Mean Interval. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Wheat, ... | | | | | | | | | | | | | 4 | 44 | |
| Barley, ... | | | | | | | | | | | | | 3 | 50 | |
| Safflower, ... | | | | | | | | | | | | | 3 | 50 | Generally grows with other crops which varies interval. |
| Gram, ... | | | | | | | | | | | | | 1 | ... | |
| Oats, ... | | | | | | | | | | | | | 6 | 30 | |
| Peas, ... | | | | | | | | | | | | | 2 | 60 | |
| Carrots, ... | | | | | | | | | | | | | 5 to 10 | 20 to 60 | |
| Potatoes, ... | | | | | | | | | | | | | 10 | 10 to 20 | |
| Opium, ... | | | | | | | | | | | | | 8 | 20 | |
| Tobacco, ... | | | | | | | | | | | | | 6 to 30 | 4 to 20 | |
| Indigo, ... | | | | | | | | | | | | | 2 | | with good rains. |
| Cotton. ... | | | | | | | | | | | | | 2 | | " " " |
| Sugarcane, ... | | | | | | | | | | | | | 2 to 10 | 2 | " " " |

Mean Waterings, No.,
" Interval, days,

PLATE XIV.

00108322

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on 01 February, 2020